



**ORGANIZACION DE LOS ESTADOS AMERICANOS
ORGANIZATION OF AMERICAN STATES**

**Comisión Interamericana de Telecomunicaciones
Inter-American Telecommunication Commission**

**XIV MEETING OF PERMANENT
CONSULTATIVE COMMITTEE III:
RADIOCOMMUNICATIONS
December 6 to 10, 1999
San Diego, California, United States of America**

**OEA/Ser.L/XVII.4.3
PCC.III/doc. 1523/99 rev.1
25 December 1999
Original: English**

**COMMON PROPOSALS AND DRAFT COMMON PROPOSALS
OF CITEL FOR WRC-2000**

(REVISION OF THE DOC. PCC.III/doc.1436/99rev.2)

(Item on the Agenda: 4.1)

(Document Submitted by the Chairman)

NOTE:

**All the proposals in this document have been sequentially numbered with the format
“../item on the agenda/1-219”.**

**The proposals that also are identified as “IAP/item on the agenda/1-73” have been sent to the
International Telecommunication Union as they have the support of at least five Member States.**

PRELIMINARY SUPPORT TO THE IAPs

January 17, 2000

| IAP # | Topic | Agenda item | A | T | R | A | B | R | B | L | O | L | B | C | A | N | C | H | L | M | T | R | D | M | A | E | Q | A | S | L | V | G | R | T | M | G | U | Y | H | T | I | N | D | J | M | C | X | N | C | G | P | N | R | P | R | G | U | D | S | O | M | N | C | A | V | C | T | U | R | D | U | S | A | R | G | N | V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| IAP # | Topic | Agenda item | A | A | B | B | B | B | B | C | C | C | C | D | E | S | G | G | G | H | H | J | M | N | P | P | P | D | S | L | V | S | T | U | U | V | |
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WRC-2000 Agenda Item 1.2

to finalize remaining issues in the review of Appendix S3 to the Radio Regulations with respect to spurious emissions for space services, taking into account Recommendation 66 (Rev.WRC-97) and the decisions of WRC-97 on adoption of new values, due to take effect at a future time, of spurious emissions for space services

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, El Salvador, United States

Background Information: Recommendation No. 66 (Rev. WRC-97) directs the ITU-R to submit a report to WRC-2000 with a view to finalizing the space services spurious emissions limits in Appendix S3 of the Radio Regulations. The CITEL administrations propose text that would remove the “design objectives” designation from the space services spurious emissions limits and make related appropriate modifications applicable to deep-space systems, satellites with spurious emissions falling within the necessary bandwidth of another transmitter on the same satellite, and amateur earth stations below 30 MHz. Also, the CITEL administrations propose to adequately recognize the case of very narrowband and unmodulated signals, particularly for the space services. Furthermore, the CITEL administrations propose to correct an oversight in Appendix S3 regarding limits for the radiodetermination service, and specify that spurious emission levels for radar systems be determined from radiated emissions.

Proposal(s):

APPENDIX S3

Table of Maximum Permitted Spurious Emission Power Levels

(See Article S3)

APS3

1. The following sections indicate the maximum permitted levels of spurious emissions, in terms of power as indicated in the tables, of any spurious component supplied by a transmitter to the antenna transmission line. Section I is applicable until 1 January 2012 to transmitters installed on or before 1 January 2003; Section II is applicable to transmitters installed after 1 January 2003 and to all transmitters after 1 January 2012. This Appendix does not cover out-of-band emissions. Out-of-band emissions are dealt with in No. S4.5 of the Radio Regulations.
2. Spurious emission from any part of the installation, other than the antenna and its transmission line, shall not have an effect greater than would occur if this antenna system were supplied with the maximum permitted power at that spurious emission frequency.

3. These levels shall not, however, apply to emergency position-indicating radiobeacon (EPIRB) stations, emergency locator transmitters, ships' emergency transmitters, lifeboat transmitters, survival craft stations or maritime transmitters when used in emergency situations.

4. For technical or operational reasons, more stringent levels than those specified may be applied to protect specific services in certain frequency bands. The levels applied to protect these services, such as safety and passive services, shall be those agreed upon by the appropriate world radiocommunication conference. More stringent levels may also be fixed by specific agreement between the administrations concerned. Additionally, special consideration of transmitter spurious emissions may be required for the protection of safety services, radio astronomy and space services using passive sensors. Information on the levels of interference detrimental to radio astronomy, Earth exploration satellites and meteorological passive sensing is given in the most recent version of Recommendation ITU-R SM.329.

5. Spurious emission limits for combined radiocommunication and information technology equipment are those for the radiocommunication transmitters.

Section I. Spurious Emission Limits for Transmitters Installed on or Before 1 January 2003 (valid until 1 January 2012)

**IAP/1.2/1
MOD**

6. ~~Rad~~ Radar systems are exempt from spurious emission limits under this section. ~~The measurement methods for radar systems should be guided by Recommendation ITU-R M.1177. For those radar systems for which acceptable methods of measurement do not exist,~~ The lowest practicable power of spurious emission should be achieved.

TABLE I

Attenuation values and absolute mean power levels used to calculate maximum permitted spurious emission power levels for use with radio equipment

| Frequency band containing the assignment (lower limit exclusive, upper limit inclusive) | For any spurious component, the attenuation (mean power within the necessary bandwidth relative to the mean power of the spurious component concerned) shall be at least that specified below and the absolute mean power levels given shall not be exceeded (Note 1) |
|--|---|
| 9 kHz to 30 MHz | 40 decibels 50 milliwatts 2), 3), 4) |
| 30 MHz to 235 MHz – mean power above 25 watts | 60 decibels 1 milliwatts 5) |
| – mean power 25 watts or less | 40 decibels 25 microwatts |
| 235 MHz to 960 MHz – mean power above 25 watts | 60 decibels 20 milliwatts |

| | |
|--|---|
| – mean power 25 watts or less | 6), 7) 40 decibels 25 microwatts 6), 7) |
| 960 MHz to 17.7 GHz – mean power above 10 watts | 50 decibels 100 milliwatts 6), 7), 8), 9) |
| – mean power 10 watts or less | 100 microwatts 6), 7), 8), 9) |
| Above 17.7 GHz | The lowest possible values achievable shall be employed (see Recommendation 66 (Rev.WRC-97)). |

Notes to Table I

¹ When checking compliance with the provisions of the table, it shall be verified that the bandwidth of the measuring equipment is sufficiently wide to accept all significant components of the spurious emission concerned.

² For mobile transmitters which operate below 30 MHz, any spurious component shall have an attenuation of at least 40 decibels without exceeding the value of 200 milliwatts, but every effort should be made to comply with the level of 50 milliwatts wherever practicable.

³ For transmitters of a mean power exceeding 50 kilowatts which can operate on two or more frequencies covering a frequency range approaching an octave or more, while a reduction below 50 milliwatts is not mandatory, a minimum attenuation of 60 decibels shall be provided.

⁴ For hand-portable equipment of mean power less than 5 watts, the attenuation shall be 30 decibels, but every practicable effort should be made to attain 40 decibels attenuation.

⁵ Administrations may adopt a level of 10 milliwatts provided that harmful interference is not caused.

⁶ Where several transmitters feed a common antenna or closely spaced antennas on neighbouring frequencies, every practicable effort should be made to comply with the levels specified.

⁷ Since these levels may not provide adequate protection for receiving stations in the radio astronomy and space services, more stringent levels might be considered in each individual case in the light of the geographical position of the stations concerned.

⁸ These levels are not applicable to systems using digital modulation techniques, but may be used as a guide. Values for these systems may be provided by the relevant ITU-R Recommendations, when available (see Recommendation **66 (Rev.WRC 97)**).

⁹ These levels are not applicable to stations in the space services, but the levels of their spurious emissions should be reduced to the lowest possible values compatible with the technical and economic constraints to which the equipment is subject. Values for these systems may be provided by the relevant ITU-R Recommendations, when available (see Recommendation **66 Rev.WRC-97**).

**Section II. Spurious Emission Limits for Transmitters
Installed After 1 January 2003 and for All
Transmitters After 1 January 2012**

Application of these limits

**IAP/1.2/2
MOD**

7. The frequency range of the measurement of spurious emissions is from 9 kHz to 110 GHz or the second harmonic if higher.

8. Guidance regarding the methods of measuring spurious emissions is given in the most recent version of Recommendation ITU-R SM.329. The e.i.r.p. method specified in that Recommendation should be used when it is not possible to measure the power supplied to the antenna transmission line, or for specific applications, such as radars, where the antenna is designed to provide significant attenuation at the spurious frequencies. Additionally, the e.i.r.p. method may need some modification for special cases, e.g. beam-forming radars.

9. Guidance regarding the methods of measuring spurious emissions from radar systems is given in the most recent version of Recommendation ITU-R M.1177. The reference bandwidths required for proper measurement of radar spurious emissions should be calculated for each particular radar system. Thus, for the three general types of radar pulse modulation utilized for radionavigation, radiolocation, acquisition, tracking and other radiodetermination functions, the reference bandwidth values should be:

- for fixed-frequency, non-pulse-coded radar, one divided by the radar pulse length, in seconds (e.g. if the radar pulse length is 1 microsecond, then the reference bandwidth is $1/1\mu\text{s} = 1\text{ MHz}$);
- for fixed-frequency, phase coded pulsed radar, one divided by the phase chip length, in seconds (e.g. if the phase coded chip is 2 microseconds long, then the reference bandwidth is $1/2\mu\text{s} = 500\text{ kHz}$);
- for frequency modulated (FM) or chirped radar, the square root of the quantity obtained by dividing the radar bandwidth in MHz by the pulse length, in seconds (e.g. if the FM is from 1 250 to 1 280 MHz or 30 MHz during the pulse of 10 microseconds, then the reference bandwidth is $(30\text{ MHz}/10\mu\text{s})^{1/2} = 1.73\text{ MHz}$).

For those radar systems for which acceptable methods of measurement do not exist, the lowest practicable power of spurious emission should be achieved.

10. The spurious emission levels are specified in the following reference bandwidths:

- 1 kHz between 9 kHz and 150 kHz
- 10 kHz between 150 kHz and 30 MHz
- 100 kHz between 30 MHz and 1 GHz
- 1 MHz above 1 GHz

As a special case, the reference bandwidth of all space service spurious emissions should be 4 kHz.

11. For the purpose of setting limits, all emissions, including harmonic emissions, intermodulation products, frequency conversion products and parasitic emissions, which fall at frequencies separated from the centre frequency of the emission by $\pm 250\%$, or more, of the necessary bandwidth of the emission will generally be considered as spurious

emissions. However, this frequency separation may be dependent on the type of modulation used, the maximum bit rate in the case of digital modulation, the type of transmitter and frequency coordination factors. For example, in the case of digital (including digital broadcasting) modulation systems, broadband systems, pulsed modulation systems and narrow-band high power transmitters, the frequency separation may need to differ from the $\pm 250\%$ factor. For multichannel or multicarrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the centre frequency of the emission is taken to be the centre of the -3 dB bandwidth of the transmitter or transponder and the necessary bandwidth is taken to be the transmitter or transponder bandwidth.

**IAP/1.2/3
ADD**

11 bis. As an emitted signal becomes more and more narrow (to the limiting case of an unmodulated carrier with theoretical necessary bandwidth of zero), the application of the term “necessary bandwidth” as used in determining the region where spurious emission limits apply to space services, becomes more and more difficult. In the limit, $\pm 250\%$ of necessary bandwidth (generally recognised as establishing the region beyond which spurious emissions are defined), approaches zero. Beacon and other unmodulated signals, such as those used in uplink and downlink circuits in control and tracking of satellites, are examples of a case where it is difficult to practically apply the term “necessary bandwidth” in determining where out-of-band emissions end, and spurious emissions begin. Pending further studies and definitive action by a future World Radiocommunication Conference, in calculating the region where spurious emission limits apply for transmitters using amplifiers to pass essentially an unmodulated signal (or a signal with very small bandwidth), the amplifier bandwidth is taken to be the necessary bandwidth (in calculating the regions where spurious emissions apply).

**IAP/1.2/4
ADD**

11 ter For satellites employing more than one transponder, and when considering the limits for spurious emission as indicated by Headnote 11 to Appendix S3, spurious emissions from one transponder may fall on a frequency at which a companion, second transponder is transmitting or in the guard band between two transponders. In this situation, the level of spurious emission from the first transponder is well exceeded by fundamental emissions of the second transponder or within the guard bands between the different transponders. Therefore, limits in this appendix do not apply to those spurious emissions on a satellite which fall within the bands where there are transmissions from the same satellite into the same service area.

12. Examples of applying $43 + 10 \log (P)$ to calculate attenuation requirements

Where specified in relation to mean power, spurious emissions are to be at least x dB below the total mean power P , i.e. $-x$ dBc. The power P (in watts) is to be measured in a bandwidth wide enough to include the total mean power. The spurious emissions are to be measured in the reference bandwidths given in the Recommendation. The measurement of the spurious emission power is independent of the value of necessary bandwidth. Because the absolute emission power limit, derived from $43 + 10 \log (P)$, can become too stringent for high-power transmitters, alternative relative powers are also provided in Table II.

Example 1

A land mobile transmitter, with any value of necessary bandwidth, must meet a spurious emission attenuation of $43 + 10 \log (P)$, or 70 dBc, whichever is less stringent. To measure spurious emissions in the frequency range between 30 MHz and 1 000 MHz,

Recommendation ITU-R SM.329-7 *recommends* 4.1 indicates the use of a reference bandwidth of 100 kHz. For other frequency ranges, the measurement must use the appropriate reference bandwidths given in *recommends* 4.1.

With a measured total mean power of 10 watts:

- Attenuation relative to total mean power = $43 + 10 \log (10) = 53 \text{ dBc}$.
- The 53 dBc is less stringent than 70 dBc, so the 53 dBc value is used.
- Therefore: Spurious emissions must not exceed 53 dBc in a 100 kHz bandwidth, or converting to an absolute level, spurious emissions must not exceed 10 dBW – 53 dBc = –43 dBW in a 100 kHz reference bandwidth.

With a measured total mean power of 1 000 watts:

- Attenuation relative to total mean power = $43 + 10 \log (1\,000) = 73 \text{ dBc}$.
- The 73 dBc is more stringent than 70 dBc limit, so the 70 dBc value is used.
- Therefore: Spurious emissions must not exceed 70 dBc in a 100 kHz bandwidth, or converting to an absolute level, spurious emissions must not exceed 30 dBW – 70 dBc = –40 dBW in a 100 kHz reference bandwidth.

Example 2

A space service transmitter with any value of necessary bandwidth must meet a spurious emission attenuation of $43 + 10 \log (P)$, or 60 dBc, whichever is less stringent. To measure spurious emissions at any frequency, Note 1 to Table II indicates using a reference bandwidth of 4 kHz.

With a measured total mean power of 20 watts:

- Attenuation relative to total mean power = $43 + 10 \log (20) = 56 \text{ dBc}$.
- The 56 dBc is less stringent than the 60 dBc limit, so the 56 dBc value is used.
- Therefore: Spurious emissions must not exceed 56 dBc in a 4 kHz reference bandwidth, or converting to an absolute level, spurious emissions must not exceed 13 dBW – 56 dBc = –43 dBW in a 4 kHz reference bandwidth.

**IAP/1.2/5
ADD**

TABLE II
**Attenuation values used to calculate maximum permitted spurious emission
power levels for use with radio equipment**

| Service category in accordance with Article S1, or equipment type ¹⁵⁾ | Attenuation (dB) below the power supplied to the antenna transmission line |
|--|--|
| All services except those services quoted below: | $43 + 10 \log (P)$, or 70 dBc, whichever is less stringent |
| Space services (earth stations) ^{10), 14), 16)} | $43 + 10 \log (P)$, or 60 dBc, whichever is less stringent |

| | |
|---|---|
| Space services (space stations) 10), 14), <u>17</u>) | $43 + 10 \log (P)$, or 60 dBc, whichever is less stringent |
| Radiodetermination ¹⁴⁾ | $43 + 10 \log (PEP)$, or 60 dB, whichever is less stringent |
| Broadcast television ¹¹⁾ | $46 + 10 \log (P)$, or 60 dBc, whichever is less stringent, without exceeding the absolute mean power level of 1 mW for VHF stations or 12 mW for UHF stations. However, greater attenuation may be necessary on a case by case basis. |
| Broadcast FM | $46 + 10 \log (P)$, or 70 dBc, whichever is less stringent; the absolute mean power level of 1 mW should not be exceeded |
| Broadcasting at MF/HF | 50 dBc; the absolute mean power level of 50 mW should not be exceeded |
| SSB from mobile stations ¹²⁾ | 43 dB below <i>PEP</i> |
| Amateur services operating below 30 MHz (including with SSB) ¹²⁾ , <u>16</u>) | $43 + 10 \log (PEP)$, or 50 dB, whichever is less stringent |

TABLE II (END)

| Service category in accordance with Article S1, or equipment type 15) | Attenuation (dB) below the power supplied to the antenna transmission line |
|--|---|
| Services operating below 30 MHz, except space, radiodetermination, broadcast, those using SSB from mobile stations, and amateur ¹²⁾ | $43 + 10 \log (X)$, or 60 dBc, whichever is less stringent, where $X = PEP$ for SSB modulation, and $X = P$ for other modulation |
| Low-power device radio equipment ¹³⁾ | $56 + 10 \log (P)$, or 40 dBc, whichever is less stringent |
| Emergency position-indicating radio beacon Emergency locator transmitter Personal location beacon Search and rescue transponder Ship emergency, lifeboat and survival craft transmitters Land, aeronautical or maritime transmitters when used in emergency | No limit |

P: mean power in watts supplied to the antenna transmission line, in accordance with No. **S1.158**. When burst transmission is used, the mean power *P* and the mean power of any spurious emissions are measured using power averaging over the burst duration.

PEP: peak envelope power in watts supplied to the antenna transmission line, in accordance with No. **S1.157**.

dBc: decibels relative to the unmodulated carrier power of the emission. In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power *P*.

Notes to Table II

¹⁰ Spurious emission limits for all space services are stated in a 4 kHz reference bandwidth.

¹¹ For analogue television transmissions, the mean power level is defined with a specified video signal modulation. This video signal has to be chosen in such a way that the maximum mean power level (e.g. at the video signal blanking level for negatively modulated television systems) is supplied to the antenna transmission line.

¹² All classes of emission using SSB are included in the category "SSB".

¹³ Low-power radio devices having a maximum output power of less than 100 mW and intended for short-range communication or control purposes; such equipment is in general exempt from individual licensing.

IAP/1.2/6

MOD

¹⁴ ~~These values are “design objectives”. This note will not be applicable after the 1999 World Radiocommunication Conference. Radiodetermination (Radar) system spurious emission dB attenuation shall be determined for radiated emission levels, not at the antenna transmission line. The measurement methods for determining the radiated spurious emission levels from the radar systems should be guided by Recommendation ITU-R M.1177.~~

¹⁵ In some cases of digital modulation (including digital broadcasting), broadband systems, pulsed modulation and narrow-band high-power transmitters for all categories of services, there may be difficulties in meeting limits close to $\pm 250\%$ of the necessary bandwidth.

IAP/1.2/7

ADD

¹⁶ Amateur earth stations operating below 30 MHz are in the service category ‘Amateur services operating below 30 MHz (including with SSB).’

IAP/1.2/8

ADD

¹⁷ Space stations, intended to operate in deep space (defined in S1.177) are exempt from spurious emission limits.

Reasons: Recommendation No. **66 (Rev. WRC–97)** directs the ITU-R to submit a report to the next WRC with a view to finalizing the space services spurious emissions limits in Appendix **S3** of the Radio Regulations. The CITEL administrations propose to confirm the values in Table II and “clean up” the table by removing the “design objectives” designation from the space services spurious emissions limits. Furthermore, by clarifying the exemption of radar systems from the Section I limits, the CITEL administrations propose to correct an oversight in Appendix **S3** regarding limits for the radiodetermination service that may lead incorrectly to the application of the Section I limits to radars. Also, the CITEL administrations propose to clarify the application of the e.i.r.p. measurement method to radars particularly, but also to other systems where antenna line measurements may not be appropriate.

WRC-2000 Agenda Item 1.4

to consider issues concerning allocations and regulatory aspects related to Resolutions 126 (WRC-97), 128 (WRC-97), 129 (WRC-97), 133 (WRC-97), 134 (WRC-97) and 726 (WRC-97);

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Grenada], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, El Salvador, Guatemala, United States

Proposal for the Confirmation of the Fixed Service Allocation in the 31.8 – 33.4 GHz Frequency Range (Resolution 126 and 726)

Background Information: Resolutions 126 and 726 invite the ITU-R to address, among other issues, sharing between High Density Fixed Systems (HDFS) and other radiocommunication services sharing spectrum in the bands 31.8 - 33.4 GHz, 51.4 - 52.6 GHz, 55.78 - 59 GHz and 64 - 66 GHz bands.

At WRC-97, a number of frequency bands above 30 GHz were identified through Resolution 726 as available for the deployment of high density fixed systems. Included in Resolution 726 is the frequency range 31.8 - 33.4 GHz. WRC-97 amended the table of frequency allocations to include the fixed service on a primary basis in the 31.8 - 33.4 GHz range subject to conditions found in Resolution 126. The first condition stipulated that this allocation to the fixed service would not go into force until January 1, 2001. Secondly, this allocation would be reviewed at WRC-2000 taking into account the results of sharing studies and the future requirements of the other allocated services. The frequency range 31.8 - 33.4 GHz has also has primary allocations to the radionavigation, space research (space-to-Earth) (deep space) and the inter-satellite services.

The ITU-R, through various working parties, have studied the sharing potential between the fixed service (high density applications) and the other primary services. With regard to sharing between the fixed and radionavigation service, studies indicated that sharing may be possible through the use of appropriate mitigation and operational measures, recognizing that fixed systems may receive emissions from airborne radionavigation systems. However, actual interference events are expected to be rare. The CPM Report recommended that sharing between the fixed and radionavigation service could be addressed through the development of appropriate ITU-R Recommendations. Sharing between the fixed service and the deep space facilities is considered practical as there are only a few deep space sites in the world and coordination with the fixed stations is feasible. It would be appropriate to adopt a suitable free-space spectral pfd limit at the surface of the Earth in order to provide adequate protection to HDFS systems from BSS satellites in a temporary near-Earth orbit phase. Studies have also concluded that interference levels from high density fixed stations into inter-satellite receivers are well within acceptable limits.

Proposal(s):

**IAP/1.4/9
MOD**

29.9 – 34.2 GHz

| <u>ALLOCATION TO SERVICES</u> | | |
|-------------------------------|--|-----------------|
| Region 1 | Region 2 | Region 3 |
| 31.8 – 32 | FIXED S5.547A MOD S5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) MOD S5.547 S5.547B S5.548 | |
| 32 – 32.3 | FIXED S5.547A MOD S5.547A INTER-SATELLITE RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) MOD S5.547 S5.547C S5.548 | |
| 32.3 – 33 | FIXED S5.547A MOD S5.547A INTER-SATELLITE RADIONAVIGATION MOD S5.547 S5.547D S5.548 | |
| 33 – 33.4 | FIXED S5.547A MOD S5.547A RADIONAVIGATION MOD S5.547 S5.547E | |

**IAP/1.4/10
SUP**

Suppress Resolution 726

~~RESOLUTION 726 (WRC 97)~~

~~Frequency bands above 30 GHz available for high-density applications in the fixed service~~

**IAP/1.4/11
MOD**

S5.547 The bands 31.8 – 33.4 GHz, 51.4 – 52.6 GHz, 55.78 – 59 GHz and 64 – 66 GHz are available for high-density applications in the fixed service (~~see Resolution 726 (WRC 97)~~).

**IAP/1.4/12
SUP**

Suppression of Resolution 126

~~RESOLUTION 126 (WRC 97)~~

~~Use of the frequency band 31.8 – 33.4 GHz for high-density systems in the fixed service~~

**IAP/1.4/13
MOD**

S5.547A ~~Use of the band 31.8 – 33.4 GHz by the fixed service shall be in accordance with Resolution 126 (WRC 97).~~ Due to the operational nature of the radionavigation service, systems in the fixed service operating in the 31.8 – 33.4 GHz band may be subject to emissions from airborne radionavigation systems. Interference into fixed systems is expected to be rare, however, Administrations are encouraged to take practical measures to minimize potential interference, taking into account S4.10.

Table S21-4

| Frequency Band | Service | Limit in dB (W/m ²) for angle of arrival (d) above the horizontal plane | | | Reference bandwidth |
|------------------------|---------|--|-------------------------|-------------|------------------------|
| | | 0 - 5 | 5 - 25 | 25 - 90 | |
| <u>31.8 – 32.3 GHz</u> | SRS | <u>-120</u> | <u>-120+0.75(δ - 5)</u> | <u>-105</u> | 1 MHz |
| <u>32 – 33 GHz</u> | ISS | <u>-135</u> | <u>-135 + (δ - 5)</u> | <u>-115</u> | <u>1 MHz</u> |

Reasons : Sharing studies have concluded that reasonable measures can be taken by the various services using this band to ensure practical co-existence. As a result, it is possible to confirm the fixed allocations in the band 31.8 - 33.4 GHz, and to identify this band as being available for HDFS applications. Consequently, Resolution **126** can be suppressed. In addition, the draft CPM Report to WRC-2000 provides suitable pfd limits to protect the fixed service. With regard to the band 31.8 – 33.4 GHz, Resolution **726** can be suppressed since the necessary ITU-R studies required to confirm the fixed service allocation have been completed.

WRC-2000 Agenda Item 1.6.2

Identification of a global radio control channel to facilitate multimode terminal operation and worldwide roaming of IMT-2000

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Grenada], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, El Salvador, Guatemala, Mexico, Peru, United States

Background Information: At the time that the WRC-2000 agenda was established, studies were underway within TG 8/1 examining whether global roaming could be accomplished by identifying one or more global radio control channels that could allow radios to be tuned to the appropriate frequency band identifying a “physical” channel was wanted, in favor of using other approaches that may include the development of a “logical” channel structure for this purpose.

Based on discussions to date within TG 8/1, it has been determined that facilitation of multimode terminal operation and worldwide roaming of IMT-2000 is possible without a specific physical global radio control channel.

Proposal(s):

IAP/1.6.2/ 15 There is no need to identify a global radio control channel for IMT-2000 in the Radio Regulations, therefore no action is required by WRC-2000.

WRC-2000 Agenda Item 1.7

review of the use of the HF bands by the aeronautical mobile (R) and maritime mobile services with a view to protecting operational, distress and safety communications, taking into account Resolution 346 (WRC-97)

Proposal to protect the operational, distress and safety communications in the HF bands used by the aeronautical mobile (R) and maritime mobile services

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, El Salvador, Mexico, United States

Background Information: WP8B and the CPM have identified two issues comprising this agenda item;

- 1) HF bands allocated for the distress and safety communications of the maritime and aeronautical mobile (R) services have been subjected to an increase in harmful interference caused by unauthorized use. It is essential for the safety-of-life and property that these distress and safety channels are kept free from unauthorized use and harmful interference.
- 2) Several maritime HF distress and safety frequencies are also used for international routine calling. The routine calling can cause interference to distress and safety communications due to the caller not being aware of ongoing traffic on the ship calling frequency since the ship is tuned to a different receive frequency for coast station calls and replies.

In addition, both the CPM Report and the report of the SCRPM to the CPM address the issue of interference in the HF bands by providing possible methods with satisfying this agenda item. One method proposes the modification of Resolution 207, where administrations would be drawn towards the fact that the interference is often due to unauthorized sources and to study solutions in assisting the mitigation of this interference. Another method calls upon the ITU-R to study the future technical and operational needs of the maritime mobile and aeronautical mobile (R) services in particular solutions providing effective and efficient distress and safety communications. Therefore, CITEL administrations propose the modification of Resolution 207 and the addition of new Resolution [HF].

MARITIME ISSUES

The protection of maritime HF distress and safety frequencies, in particular the frequencies 12 290 kHz and 16 420 kHz, is addressed in Resolution **346 (WRC-97)**. A significant source of interference to distress traffic on these frequencies is due to their use as calling frequencies. Resolution **346** calls for administrations to minimize the use of these frequencies for non-safety calling purposes by coast and ship stations.

GMDSS distress and safety frequencies are also used for calling in some of the other maritime HF bands. In each maritime HF band one channel is designated as an international calling channel pair for radiotelephony. In

the 4, 6, 12 and 16 MHz bands, the distress and safety frequency is the same as the ships transmitting frequency on the calling channel.

The radio telephony calling channels are used on duplex basis, whilst the distress and safety frequencies are used on simplex. When a ship is calling a coast station, it transmits on the distress frequency. The problem is that at times that the ship has difficulty monitoring whether or not there is ongoing distress traffic, because its receiver is on the corresponding coast station frequency. This problem occurs in the 4, 6, 12 and 16 MHz bands and not in the 8, 18, 22 and 25 MHz bands. The problem is being caused by the transmitting station not adhering to existing regulatory standards which require a station to listen on its transmitting frequency prior to transmitting. Equipment modification may be necessary in order to listen on the ship frequency of a duplex pair prior to transmitting on that frequency.

Once initial contact has been established and working frequencies coordinated, traffic handling is accomplished directly on the coordinated working frequencies.

The CPM identified that compliance with existing Radio Regulations, **S52.224** which requires that a station listens before transmitting is a method to help alleviate the interference problem. Further regulations are not required, rather enforcement of the existing regulation. CPM considered the modification of Article **S52** and Appendices **S13** and **S17** to exclude routine calling from the HF distress and safety frequencies as a method to satisfy the agenda item. This method may require modification of existing equipment.

CITEL administrations propose no change to divide the existing distress and calling channels in two separate frequencies, one exclusive distress and safety frequency and one international radiotelephony calling frequency. The distress frequencies should remain the same as they are at present where calling is allowed and no modifications to the distress procedures are required. Strict compliance and enforcement of existing Radio Regulations, **S52.224**, which requires that a station listen before it transmits would alleviate this problem. This proposal contains the minimum modifications required in the Radio Regulations and its Appendices in order to improve the situation on the HF radiotelephony distress and safety frequencies.

CPM further encouraged the use of digital selective calling (DSC) instead of calling by radiotelephony, while recognizing that all vessels may not be fitted with DSC.

This proposal is also encouraging ships and coast stations to use digital selective calling. If voice calling is required, it should in the first instance be done on the coast station working channel and secondarily on the appropriate calling frequency.

AERONAUTICAL ISSUES

The interference to HF frequencies allocated to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz appears to be the result of unauthorized non-aviation use of aeronautical mobile (R) frequencies. In some parts of the world the aeronautical mobile (R) HF frequencies are being used for land mobile, broadcast, fixed point-to-point communications and in maritime applications such as in support of fishing fleets. These unauthorized uses have resulted in frequent cases of harmful interference and have diminished the spectrum available for the aeronautical mobile (R) safety-of-life applications.

Administrations should ensure that stations of services other than the aeronautical mobile (R) service refrain from using frequencies in the bands allocated exclusively to the aeronautical mobile (R) service. Administrations should make every effort to identify and locate the source of any unauthorized emission causing harmful interference. Recognizing that such emissions are capable of endangering human life and property and the safe and regular conduct of aircraft operations, should take necessary measures to prevent stations from operating in contravention of ITU Radio Regulations.

WP8B and the CPM recommend modifications of Article **S15** to ensure that suitable provisions are made for the aeronautical mobile (R) service.

CITEL administrations propose modifications to Article **S15** to include reference to Appendix **S27**. This modification will ensure special consideration is given to avoiding interference on the frequencies used for safety and regularity of flight. Currently, Article **S15** only refers to Article **S31** Appendix **S13**, which is primarily for maritime services.

CITEL administrations propose no changes to Appendix **S27**. Presently, the HF bands allocated to the aeronautical mobile (R) service are nearly saturated by the use of analog voice communications. This spectrum must be maintained for the new digital high frequency data link (HF DL) communications. HF DL communications will provide a capability for the transfer of air traffic control and aeronautical operational control data to and from pilots operating over oceanic airspace, on polar routes, and in airspace over sparsely populated or undeveloped countries where other communications systems are not practical. The International Civil Aviation Organization (ICAO) will have completed Standards and Recommended Practices for HF DL before the end of 1999. Appendix **S27** contains the Allotment Plan for the aeronautical use of HF aeronautical mobile (Route) service. Review of Appendix **S27**, if necessary, should be performed by ICAO and by ITU-R Working Party 8B and consequently considered by a subsequent WRC.

Proposal(s):

ARTICLE S15

Interferences

Section I – Interference from Radio Stations

IAP/1.7/ 16

MOD

S15.8 § 4 Special consideration shall be given to avoiding interference on distress and safety frequencies and those related to distress and safety identified in Appendix **S13** and safety and regularity of flight identified in Appendix **S27**,

Reasons: Frequencies for safety and regulatory of flight in the Aeronautical Mobile (R) service are not listed in Appendix **S13**, since this appendix is primarily for maritime services. Inclusion of Appendix **S27** in this provision will ensure special consideration is given to avoiding interference on these frequencies used for safety and regularity of flight.

Section VI – Procedure in a case of harmful interference

IAP/1.7 / 17

MOD

S15.28 § 20 Recognizing that transmissions on the distress and safety frequencies and frequencies used for the safety and regularity of flight (See Article **S31**, ~~and~~ Appendix **S13** and Appendix **S27**) require absolute international protection, and that the elimination of harmful interference to such transmissions is imperative, administrations undertake to act immediately when their attention is drawn to any such harmful interference.

Reasons: Frequencies for safety and regulatory of flight in the Aeronautical Mobile (R) service are not listed in Article S31 or Appendix S13, since this appendix is primarily for maritime services. Inclusion of Appendix **S27** would lead to the protection of frequencies used for safety and regularity of flight against interference.

IAP/1.7/ 18
MOD

S15.35 § 27 On being informed that a station over which it has jurisdiction is believed to have been the cause of harmful interference, an administration shall, as soon as possible, acknowledge receipt of that information by ~~telegram~~ the quickest means available. Such acknowledgement shall not constitute an acceptance of responsibility.

Reasons: Improvements in technology provide quicker means of communicating information, such email and facsimiles. The quicker a case of interference is reported, the quicker the action can be taken against that interference, and the shorter the duration of the interference.

ARTICLE S52

Special rules relating to the use of frequencies

IAP/1.7/ 19
NOC

S52.216

C. Bands between 4 000 kHz and 27 500 kHz

C1. Mode of operation of Stations

IAP/1.7/ 20
MOD

S52.219 3) Coast stations employing class J3E or J2D emissions in accordance with No. **S52.217** in the bands between 4 000 and 27 500 kHz shall use the minimum power necessary to cover their service area and shall at no time use a peak envelope power in excess of 10 kW per channel. On the radiotelephony calling frequencies 4 417 kHz and 6 516 kHz coast stations shall limit their peak envelope power to the lowest value to maintain reliable communications, not to exceed 5 kW.

Reasons: Due to geographical differences, the higher power of 5 kW is required to provide adequate communications coverage.

IAP/1.7/ 21
NOC

S52.220 4) Ship stations employing class J3E or J2D emissions in accordance with No. **S52.217** in the bands between 4 000 kHz and 27 500 kHz shall at no time use a peak envelope power in excess of 1.5 kW per channel.

Reasons: Higher shipboard power increases the potential for interference and out of band emissions.

IAP/1.7/ 22
ADD

S52.220A Administrations should encourage the coast stations and ships under their jurisdiction to utilize the digital selective calling techniques for call and reply.

Reasons: Decreases the potential for interference on the distress channels.

IAP/1.7/ 23
ADD

S52.220B When calling by radiotelephony is necessary, it should be done (in order of preference):

Reasons: Decreases the potential for interference on the distress channels.

IAP/1.7/ 24
ADD

S52.220C (1) On the working frequencies assigned to the coast station in question or

Reasons: Decreases the potential for interference on the distress channels.

IAP/1.7/ 25
ADD

S52.220D (2) when this is not possible, on the international calling frequencies listed under **S52.221**.

Reasons: Decreases the potential for interference on the distress channels

C2. Call and reply

IAP/1.7/ 26
NOC

S52.221 § 97. (1) Ship stations may use the following carrier frequencies for calling in radiotelephony:

4 125 kHz^{3, 4, 5}
6 215 kHz^{4, 5}
8 255 kHz
12 290 kHz⁵
16 420 kHz⁵
18 795 kHz
22 060 kHz
25 097 kHz

Reasons: It is not necessary to convert calling frequencies from duplex to simplex.

IAP/1.7/ 27
NOC

³ **S52.221.1** In the United States, the carrier frequency 4 125 kHz is also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. **S5.222.2**).

Reasons: This note supports existing U.S. use of this channel in remote areas of our Search and Rescue areas of responsibility and supports communications in remote areas.

IAP/1.7/ 28
NOC

⁴ **S52.221.2** The carrier frequencies 4 125 kHz and 6 215 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for call and reply purposes, provided that the peak envelope power of such stations does not exceed 1 kW. The use of these frequencies for working purposes is not permitted (see also Appendix **S13** and No. **S52.221.1**).

Reasons: This note supports existing use of this channel in remote areas of Search and Rescue responsibility and supports communications in remote areas.

IAP/1.7/ 29
NOC

⁵ **S52.221.3** The carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz and 16 420 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for distress and safety traffic.

Reasons: This note supports existing uses and enhances maritime safety in remote geographical areas.

IAP/1.7/ 30
NOC

S52.222 (2) Coast stations may use the following carrier frequencies for calling in radiotelephony ⁶:

4417kHz⁷
6516kHz⁷
8779kHz
13137kHz
17302kHz
19770kHz
22756kHz
26 172 kHz

Reasons: Conversion to simplex operation is not necessary.

IAP/1.7/ 31
SUP

~~⁶ **S52.222.1** These frequencies may also be used by coast stations with class H2B emission, when using the selective calling system defined in Recommendation ITU-R M.257-3.~~

Reasons: This system is out of date and no longer in use.

IAP/1.7/ 32
MOD

⁷ **S52.222.2** The carrier frequencies 4 417 kHz and 6 516 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided that the peak envelope power of such stations ~~does not exceed 1 kW~~ shall be limited to the lowest value to maintain reliable communications, not to exceed 5 kW. The use of 6 516 kHz for this purpose should be limited to daytime operation (see also No. **S52.221.1**).

Reasons: Consequential to **MOD S52.219**.

IAP/1.7/ 33
NOC

S52.224 § 99. 1) Before transmitting on the carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz or 16 420 kHz a station shall listen on the frequency for a reasonable period to make sure that no distress traffic is being sent (see Recommendation ITU-R M.1171).

Reasons: It may not be a simple task to monitor the ship transmit frequency when set to a duplex calling channel.

**IAP/1.7/ 34
MOD**

S52.227 2) The frequencies to be used for the conduct of simplex radiotelephony are shown in Appendix **S17**, Sub-Section B. In these cases, the peak envelope power of the coast station transmitter shall not exceed 1 kW.

Reasons: Editorial.

APPENDIX S17

Frequencies and channeling arrangements in the high-frequency bands for the maritime mobile service

(See Article S52)

IAP/1.7/ 35

PART A – Table of subdivided bands

NOC

PART B – Channeling arrangements Section I – Radiotelephony

IAP/1.7/ 36

NOC

5. The following frequencies in Sub-Section A are allocated for calling purposes:

- (Channel No. 421 in the 4 MHz band);
- (Channel No. 606 in the 6 MHz band);
- (Channel No. 821 in the 8 MHz band);
- (Channel No. 1221 in the 12 MHz band);
- (Channel No. 1621 in the 16 MHz band);
- (Channel No. 1806 in the 18 MHz band);
- (Channel No. 2221 in the 22 MHz band);
- (Channel No. 2510 in the 25 MHz band).

The remaining frequencies in Sub-Sections A, B, C-1 and C-2 are working frequencies.

Reasons: Conversion to simplex operation is not necessary.

IAP/1.7/ 37

NOC

5A For the use of the carrier frequencies:

- 4 125 kHz (Channel No. 421)
- 6 215 kHz (Channel No. 606)
- 8 291 kHz (Channel No. 833)
- 12 290 kHz (Channel No. 1221)
- 16 420 kHz (Channel No. 1621)

In Sub-Section A, by coast and ship stations for distress and safety purposes, see Article S31 and Appendix S13.

Reasons: Conversion to simplex operation is not necessary.

SUB-SECTION A

IAP/1.7/ 38

NOC

Table of single-sideband transmitting frequencies (kHz) for duplex (two-frequency) operation

Reasons: Conversion to simplex operation is not necessary.

APPENDIX S27
Frequency allotment Plan for the aeronautical mobile (R) service and related information

Reasons: ICAO in consultation with the ITU-R should perform any review of Appendix S27, if necessary. The HF bands allocated to the aeronautical mobile (R) service are nearly saturated by the use of analog voice communications. This spectrum must be maintained for the new digital high frequency data link (HF DL) communications. The world-wide implementation of HF DL communications will reduce the burden on voice communications between pilots and controllers by using the data link for routine communications and freeing voice communications for more critical communications.

MOD

Unauthorized use of frequencies in the bands allocated to the maritime mobile service and to the aeronautical mobile (R) service

The World Administrative Radiocommunication Conference for the Mobile Services (Istanbul, 2000),

considering

- a) that provisions of the Radio Regulations prohibit the unauthorized use of certain frequencies for other than safety related communications;
 - b) that enforcing compliance with these regulatory provisions is becoming increasingly difficult with the availability of low-cost HF SSB transceivers;
 - ~~a~~c) that monitoring observations of the use of frequencies in the band 2 170-2 194 kHz and in the bands allocated exclusively to the maritime mobile service between 4 063 kHz and 27 500 kHz and to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz show that a number of frequencies in these bands are still being used by stations of other services, some of which are operating in contravention of No. **S23.2**;
 - ~~b~~d) that these stations are causing harmful interference to the maritime mobile and aeronautical mobile (R) services;
 - ~~e~~e) that HF radio is the sole means of communication in certain situations for the maritime mobile service and that certain frequencies in the bands mentioned in *considering c)* are reserved for distress and safety purposes;
 - ~~d~~f) that HF radio is the sole means of communication in certain situations for the aeronautical mobile (R) service and that this is a safety service;
 - g) that this Conference has reviewed the use of the HF bands by the aeronautical mobile (R) and maritime mobile services with a view to protecting the operational, distress and safety communications [and has adopted Resolution [HF] (WRC-2000) to study the future technical and operational needs for the existing distress and safety frequencies and possible solutions to provide for efficient and effective distress, safety and other communications beyond the year 2000],
- considering in particular*
- ~~e~~h) that it is of paramount importance that the distress and safety channels of the maritime mobile service be kept free from harmful interference, since they are essential for the protection of the safety of life and property;
 - ~~f~~i) that it is also of paramount importance that channels directly concerned with the safe and regular conduct of aircraft operations be kept free from harmful interference, since they are essential for the safety of life and property,

resolves
to urge administrations

1 to ensure that stations of services other than the maritime mobile service abstain from using frequencies in distress and safety channels and their guard bands and in the bands allocated exclusively to that service, except under the conditions expressly specified in Nos. **S4.4, S5.128, S5.129, S5.137** and **S4.13** to **S4.15**; and to ensure that stations of services other than the aeronautical mobile (R) service refrain from using frequencies allocated to that service except under the conditions expressly specified in Nos. **S4.4** and **S4.13**;

2 to make every effort to identify and locate the source of any unauthorized emission capable of endangering human life or property and the safe and regular conduct of aircraft operations, and to communicate their findings to the Radiocommunication Bureau;

3 to participate in the monitoring programmes that the Radiocommunication Bureau may organize pursuant to this Resolution;

4 to make every effort to ensure that such emissions are made in appropriate bands allocated to services other than the maritime mobile service or the aeronautical (R) mobile service;

5 to request their competent authorities to take, within their respective jurisdiction, such legislative or regulatory measures which they consider necessary or appropriate in order to prevent stations from unauthorized use of distress and safety channels or operating in contravention of No. **S23.2**,

to invite the Radiocommunication Bureau

1 to study possible solutions, technical and regulatory, to assist in mitigating HF interference;

~~2~~ to continue to organize monitoring programmes, at regular intervals, in the maritime distress and safety channels and their guard bands and in the bands allocated exclusively to the maritime mobile service between 4 063 kHz and 27 500 kHz and to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz, with a view to ensuring the timely distribution of monitoring data and identifying the stations of other services operating on these channels or in these bands;

~~23~~ to seek the cooperation of administrations in identifying the sources of those emissions by all available means and in securing the cessation of those emissions;

~~34~~ when the station of another service transmitting in a band allocated to the maritime mobile service or to the aeronautical mobile (R) service has been identified, to inform the administration concerned,

to invite ITU-R and ITU-D

- 1 to increase regional awareness of appropriate practices to help mitigate interference in the HF bands, especially on distress and emergency channels;
- 2 to include the problem of interference to distress and emergency channels on agenda of regional radiocommunication and development seminars;

requests administrations

to take all necessary steps in such cases to ensure the cessation of any transmissions contravening the provisions of the Radio Regulations on the frequencies or in the bands referred to in this Resolution.

IAP/1.7/ 41

DRAFT RESOLUTION [HF] (WRC-2000)

ADD

Technical and operational needs for distress and safety frequencies allocated to the maritime mobile service and the aeronautical mobile (R) service

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that the HF frequencies currently used by the aeronautical and maritime mobile services for distress, safety and other communications, including allotted operational frequencies, suffer from harmful interference and are often subject to difficult propagation conditions;
- b) that WRC-97 considered some aspects of the use of the HF bands for distress and safety communications in the context of the Global Maritime Distress and Safety System (GMDSS), especially with regard to regulatory measures;
- c) that existing regulatory measures prohibit the unauthorized use of certain frequencies for other than safety related traffic;
- d) that enforcing compliance with these regulatory measures is becoming increasingly difficult with the availability of low-cost HF SSB transceivers;
- e) that unauthorized operations using maritime and aeronautical HF frequencies are continuing to increase and are already a serious risk to HF distress, safety and other communications;
- f) that this Conference revised Resolution **207** regarding the unauthorized use of frequencies in the bands allocated to the maritime mobile service and to the aeronautical mobile (R) service;
- g) that there is a need for a review of the frequency assignments and provisions for HF distress, safety and aeronautical mobile (R) service communications;
- h) that some administrations have resorted to the use of transmitting warning messages on operational HF channels as a means of deterring unauthorized users,

resolves to invite ITU-R

1 to study the future technical and operational needs for the existing HF operational, distress and safety frequencies and possible solutions to provide for efficient and effective operational, distress and safety communications in the maritime mobile and aeronautical mobile (R) services beyond the year 2000;

2 to report the results of the studies referred to in *resolves* 1 to WRC-2003,

further resolves

1 to urge all administrations and concerned organizations, including IMO and ICAO, to actively participate and contribute to the ITU-R studies;

2 to urge administrations to take all practicable steps to comply with Resolution **207 (Rev.WRC-2000)**.

instructs the Secretary-General

to communicate this Resolution to the attention of the International Maritime Organization and the International Civil Aviation Organization.

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to consider regulatory and technical provisions to enable earth stations located on board vessels to operate in the fixed-satellite service (FSS) networks in the bands 3 700 - 4 200 MHz and 5 925 - 6 425 MHz, including their coordination with other services allocated in these bands;

Proposal for communications by earth stations on board vessels using frequencies allocated to the fixed-satellite service and used by existing space segment in the fixed-satellite service

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, Guatemala, United States

Background Information: This item concerns provision of communications by earth stations on board vessels (ESVs) using frequencies allocated to the fixed-satellite service and used by existing space segment in the fixed-satellite service. These stations operate in three distinct modes: at sea; while stationary in or near port; and in motion approaching or departing from port.

Operations at sea (beyond a certain distance for near-shore coordination) by ESVs in the fixed-satellite service do not present a potential for interference to stations in the fixed service operating in accordance with the 6 GHz FS allocation, and therefore need not be coordinated. Operations while these earth stations are stationary at pre-determined points can be coordinated bilaterally with fixed service systems. Technical and regulatory issues concern the potential for interference between in-motion operations by these ESVs operating close to shore and stations in the fixed service both on and offshore.

The studies that have been conducted in ITU-R have illustrated that the values for the minimum distance are principally affected by the interference criteria required to protect the fixed service and the number of passages per unit time by vessels equipped with earth stations. Based on different values for these assumptions, the results of these preliminary studies yielded a range of values for the minimum distance from 100 km to 540 km. It should be noted that studies submitted to the CPM by some administrations suggested values for the minimum distance of 150 km to 370 km. However, there should be a single minimum distance value.

Proposal(s):

IAP/1.8/ 42

MOD

3 700 - 4 200 MHz

| Allocation to services | | |
|--|--|----------|
| Region 1 | Region 2 | Region 3 |
| 3700-4200 FIXED FIXED-SATELLITE ADD S5.ESV Mobile | 3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) ADD S5.ESV MOBILE except aeronautical mobile | |

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

IAP/1.8/ 43

MOD

5 925 - 6 425 MHz

| Allocation to services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 5925-6425 | FIXED FIXED-SATELLITE (Earth-to-space) ADD S5.ESV MOBILE S5.149 S5.440 S5.458 | |

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service

IAP/1.8/ 44

ADD

S5.ESV ~~Earth stations located on board vessels may use frequencies in this band and shall operate in the fixed-satellite service in accordance with Resolution **ESV**~~ In the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz, transponders on space stations in the fixed-satellite service may be used, additionally, by earth stations on vessels. Such use is subject to the provisions specified in the procedures of Resolution **ZZZ**. (WRC-2000).

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

Provisions to enable earth stations located on board vessels to operate in fixed-satellite service networks in the bands 3 700-4 200 MHz and 5 925-6 425 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that there is a demand for global wideband satellite communication services on vessels;
- b) that the technology exists that would permit the use of fixed-satellite services (FSS) networks by earth stations on board vessels (ESVs) operating in the 3 700-4 200 and 5 925-6 425 MHz bands;
- c) that ESVs have the potential to cause unacceptable interference to the fixed service (FS) systems in the band 5 925-6 425 MHz;
- d) that FS systems have the potential to cause interference to ESVs in the 3 700-4 200 MHz band;
- e) that ESVs operating in these bands require considerably less than the full bandwidth in this FSS allocation and only a portion of the visible geostationary arc;
- f) that there are a limited number of geostationary FSS systems that have global coverage;
- g) that in order to ensure the protection and future growth of the FS, the ESV must operate with certain technical and operational constraints;
- h) that administrations may authorize radiocommunication stations on off-shore structures and platforms for which they are responsible;
- i) that based on appropriate assumptions a minimum distance can be calculated beyond which the ESV will not have the potential to cause unacceptable interference to the fixed service in this band,

noting

- a) that operation within the territorial sea is at the discretion of the administration with territorial authority, in which case the relevant procedures of that administration will apply;
- b) that operation of earth stations on vessels from specified fixed points at locations outside the territorial sea but for which an administration has territorial jurisdiction is fully within the FSS,

resolves

- 1 that the administration that issues the radio licence for the use of ESVs in these bands (licensing administration) shall ensure that such stations do not cause unacceptable interference to stations in the fixed service;
- 2 that licensing administrations shall ensure that ESVs are capable of operating in compliance with the requirements of this Resolution;
- 3 that operators of ESVs shall comply with the conditions established by the licensing administration(s);

- 4 that ESVs shall not claim protection from fixed service station transmissions;
- 5 that any transmissions from ESVs within a distance X km off any given coast shall be based upon the prior agreement of that coastal administration;
- 6 that the ESV system shall include means of identification and automatic mechanisms to terminate transmissions whenever the station operates outside its pre-authorized geographic (see *resolves* 5) or operational limits;
- 7 that ESVs shall be equipped so as to enable the licensing administration under the provisions of Article **S18** to verify earth station performance and to accomplish the switch off of the ESV transmission immediately upon request by an administration whose services may be affected;
- 8 that when ESVs operating beyond the territorial sea but within X km of the coast of an administration fail to comply with the terms required by that administration pursuant to *resolves* 3 and 5, then that administration may:
- request the ESV to comply with such terms or cease operation immediately;
or
 - request the licensing administration to require such compliance or immediate cessation of the operation;
- 9 that any licensing authority that licenses ESVs shall agree to maintain at all times a point of contact, which shall be published in a circular of the ITU, that may be contacted by an affected administration seeking assistance pursuant to *resolves* 3 and 5 above.
-

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to take into account the results of ITU-R studies in evaluating the feasibility of an allocation in the space-to-Earth direction to the mobile-satellite service in a portion of the 1 559 - 1 567 MHz frequency range, in response to Resolutions 213 and 220 (WRC-97)

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay]

Canada, Colombia, Ecuador, Mexico, Peru, Venezuela, United States

Background Information: Proposals were made to WRC-97 to reallocate portions of the 1 559 - 1 610 MHz band which, with the exception of a fixed service allocation in some countries, currently is exclusively allocated to the radionavigation satellite service and aeronautical radionavigation service worldwide. Other proposals were made not to change the existing allocations in these bands. In Resolution **220 (WRC-97)**, the ITU-R was requested to study, as a matter of urgency, the technical criteria and operational and safety requirements to determine if sharing between the aeronautical radionavigation and radionavigation-satellite services, operating or planned to be operate, in the band 1 559-1 610 MHz, and the mobile-satellite service in a portion of the 1 559-1 567 MHz frequency range, is feasible, taking into account the essential need to protect systems operating in the aeronautical radionavigation and radionavigation-satellite services in the band 1 559-1 610 MHz.

There are millions of RNSS receivers in use today for a wide range of applications, including safety-of-life-critical navigation on land, at sea, and in the air. Today, most of these receivers operate with the Global Positioning System (GPS), an important element of the Global Navigation Satellite System (GNSS) that operates in the 1 559 - 1 610 MHz band.

GPS provides position and time information to users by means of one-way transmissions using RNSS (space-to-Earth) allocations. GPS is information technology that uses systems of hardware and software, as well as information (time and ephemeris) transmitted from satellites to provide derived information to the user.

GLONASS and GPS are established elements of the International Civil Aviation Organization (ICAO) GNSS, operating in the band 1 559 - 1 610 MHz. These systems are accepted by the ICAO Council for use in international civil aviation. ICAO is currently developing Standards and Recommended Practices for international application in civil aviation. The GNSS will be used during all phases of flight, including precision approaches and landing, and under all weather conditions. The latter places extensive requirements on the performance characteristics of the system. The aeronautical use of RNSS is recognized in the Radio Regulations as a safety-of-life application. GPS is the sole basis for the formation of International Atomic Time and Coordinated Universal Time (UTC) by the International Bureau of Weights and Measures. GPS is also the primary means by which clocks are synchronized within telecommunications networks for Time Division Multiple Access transmissions. Time and frequency functions are or will be available on other RNSS systems.

As Resolution **220 (WRC-97)** recognizes RNSS and ARNS systems are evolutionary and other types of GNSS are under development for operation in the band 1 559 - 1 610 MHz. There are both aeronautical and non-aeronautical safety-of-life services in the 1 559 - 1 610 MHz band, and it is well established that there is an essential need to protect systems operating in the ARNS and RNSS.

The core signal structures of the MSS and the RNSS and ARNS are fundamentally different: MSS uses a two-way signal while ARNS and RNSS transmits a weak, receive-only signal. Having systems from a radiocommunication service operate on a co-primary, co-frequency basis in the 1 559 - 1 610 MHz band would limit ARNS and RNSS operators' flexibility to adjust their spectrum usage, and would hamper efforts to develop a GNSS that is capable of meeting evolving international needs and of providing adequate protection for international civil use worldwide.

Studies undertaken in the ITU addressed current aeronautical radionavigation and radionavigation-satellite service systems, as well as future radionavigation services planned for this band.

These studies reached the following conclusions:

- MSS (space-to-Earth) and ARNS/RNSS are fundamentally incompatible in any portion of the 1 559-1 567 MHz band. Not only do MSS signals disrupt ARNS/RNSS, but GNSS pseudolites disrupt MSS signals.
- The -112 dB(W/m²/MHz) power flux-density level at the Earth's surface that is mentioned in Resolution 220 clearly would not protect existing RNSS systems (such as GPS) from harmful interference.
- The RNSS is extensively used, and is continuing to undergo a tremendous expansion which drives further evolution. These factors, along with the many critical timing, positioning, and navigation uses of RNSS sharing of the 1 559-1 610 MHz band, weigh conclusively against sharing any portion of the band segment at 1 559-1 567 MHz with any co-frequency communication service.
- The use of pseudolites in the ARNS/RNSS bands at 1 559-1 567 MHz is in its early stages, but is expected to increase in terms of numbers, geographic scope, and complete utilization of the frequency band in the near future. This use is incompatible with co-frequency MSS (space-to-Earth).

Proposal(s):

IAP/1.9/46

NOC

CITEL Administrations propose that no allocation be made to the Mobile Satellite Service (space-to-Earth) in any portion of the 1559 - 1567 MHz band under agenda item 1.9.

Reasons: The current allocation, 1 559 - 1 610 MHz, is required for radionavigation services, including critical aeronautical safety applications, on a worldwide basis. Based on studies conducted in the ITU-R pursuant to Resolution **220**, sharing in this band with communications services such as the mobile-satellite service (space-to-Earth) is not possible.

IAP/1.9/47

SUP

~~RESOLUTION 220 (WRC-97)~~

~~Studies to consider the feasibility of use of a portion of the band 1559-1610 MHz by the mobile-satellite service (space-to-Earth)~~

Reasons: Studies performed by the ITU-R show that co-frequency sharing between the mobile-satellite service and the radionavigation-satellite and aeronautical radionavigation services within the band 1559 - 1567 MHz is not feasible. The ITU-R studies satisfy the requirement of Resolution **220 (WRC-97)**. As a result, Resolution **220** should be suppressed.

WRC-2000 Agenda Item 1.11

to consider constraints on existing allocations and to consider additional allocations on a worldwide basis for the non-geostationary (non-GSO) MSS below 1 GHz, taking into account the results of ITU-R studies conducted in response to Resolutions 214 (Rev.WRC-97) and 219 (WRC-97)

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Colombia, United States

Background Information: A number of studies have been carried out since MSS allocations for non-GSO satellite systems were first agreed at WARC-92. These have led to ITU-R Recommendations which indicate the sharing techniques which are being used by those systems to share with each other and other co-primary services.

The table below (Non-GSO MSS Sharing Summary) from Recommendation ITU-RM.[YA] “Methods for achieving coordinated use of multiple non-GSO MSS systems below 1 GHz and sharing with other services in existing MSS allocations” summarizes the techniques and Recommendations applied to existing MSS allocations. Many of these techniques are being employed in practice successfully.

Non-GSO MSS Sharing Summary

| | Narrow-band | Wideband |
|--|---|--|
| Fixed and mobile (148-149.9 MHz) (455-456 MHz and (459-460 MHz in Region 2) (454-455 MHz by footnotes) | Combination: - Dynamic channel avoidance (Rec. ITU-R M.1039) - Low duty cycle - Brief message duration - (Rec.ITU-R M. 1185) | Combination: - Low output power density - Brief message duration - Low data rate - Filtering at satellite - Geographical separation |
| Fixes and mobile (137-138 MHz) (400.15-401 MHz) | Ground level pfd per RR S5.208 | Ground level pfd per RR S5.208 |
| Meteorological satellites (137-138 MHz) (400.15-401 MHz) | Assignment separation | Combination: - Low pfd at ground level - Cross polarization discrimination - Adaptive filter at satellite |
| Space operations Space research (137-138 MHz) | Channel avoidance | Combination: - Low pfd - Cross polarization discrimination |

| | | |
|---|-------------------|--|
| Space research (400.15-401 MHz) | Channel avoidance | Combination: - Low pfd - Cross polarization discrimination |
| Meteorological aids (400.15-401 MHz) | Channel avoidance | Combination: - Low pfd - Cross polarization discrimination |

The constraints on existing allocations are reflected in the footnotes to the allocations, and in the Annex 1 to Appendix **S5**. These have evolved to their present form since WARC-92, and now reflect a balance with regard to sharing criteria among the primary services concerned.

These constraints have served to provide a basis for implementing non-GSO MSS systems in these bands and at the same time provide protection to other space and terrestrial services. Therefore in respect to the constraints of the MSS in existing allocations below 1 GHz, no further modifications are needed.

Proposal(s):

../1.11/48

NOC

S9.11A *e)* for a station for which the requirement to coordinate is included in a footnote of the Table of Frequency Allocations referring to this provision:

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

APPENDIX S5

ANNEX 1

1. Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands.

1.1 Below 1 GHz

../1.11/49

NOC

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **S5.204** and **S5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds - 125 dB (W/m²/4 kHz) at the Earth's surface.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

../1.11/50

NOC

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

- 125 dB (W/m²/4 kHz) for networks for which complete Appendix **3** coordination information has been received by the Bureau prior to 1 November 1996;
- 140 dB (W/m²/4 kHz) for networks for which complete Appendix **S4/3** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

../1.11/51

NOC

1.1.2 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix **3** coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds - 125 dB(W/m²/4 kHz) at the Earth's surface for the administrations referred to in § 1.1.1 above.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

3.2 General considerations

../1.11/52
NOC

TABLE 1
EARTH STATIONS OPERATING AT FREQUENCIES BELOW 1 GHZ

Reasons: No modifications are required to the Tables of criteria applicable to MSS allocations for use by Non-GSO systems below 1 GHz, as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

WRC-2000 Agenda Item 1.12

to consider progress of studies on sharing between feederlinks of non-geostationary satellite networks in the mobile satellite service and geostationary-satellite networks in the fixed satellite service in the bands 19.3-19.7 GHz and 29.1-29.5 GHz, taking into account Resolution 121 (Rev.WRC-97)

Proposal for the modification of S5.541A and the suppression of Resolution 121

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, Mexico, United States

Background Information: Resolution 121 requests that the ITU-R conduct a study of sharing possibilities between GSO FSS and NGSO MSS feederlinks in the bands. In response ITU-R WP-4A of Study Group 4 has agreed a Draft New Recommendation, "Mitigation Techniques to Facilitate Coordination in the 20/30 GHz NGSO MSS Feederlinks".

The Recommendation includes the topics of Adaptive Power Control, High Gain Antennas, Geographic Isolation, Site Diversity and Link Balancing.

This Recommendation is considered to have covered the requirements of Resolution 121 (Rev. WRC-97) and thus satisfies the agenda.

Proposal(s):

../1.12/53
IAP/1.12/48
MOD

S5.541A Feeder links of non-geostationary networks in the mobile-satellite service and geostationary networks in the fixed-satellite service operating in the band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks. These methods shall apply to networks for which Appendix S4 coordination information is considered as having been received by the Bureau after 17 May 1996 and until they are changed by a future competent world radiocommunication conference. Administrations submitting Appendix S4 information for coordination before this date are encouraged to utilize these techniques to the extent practicable. ~~These methods are also subject to review by ITU-R (see Resolution 121 (Rev.WRC-97)).~~

Reasons : The objective of Resolution 121 has been addressed through the development of a Draft New Recommendation in Study Group 4 of the ITU-R.

../1.12/54
IAP/1.12/49
SUP

~~RESOLUTION 121 (Rev.WRC 97)~~

~~Continued development of interference criteria and methodologies for fixed-satellite service coordination between feeder links of non-geostationary satellite networks in the mobile-satellite service and geostationary-satellite networks in the fixed-satellite service in the bands 19.3-19.7 GHz and 29.1-29.5 GHz~~

Reasons: The objectives of Resolution 121 have been met.

WRC-2000 Agenda Item 1.13

on the basis of the results of the studies in accordance with Resolutions 130 (WRC-97), 131 (WRC-97) and 538 (WRC-97):

1.13.1 to review and, if appropriate, revise the power limits appearing in Articles S21 and S22 in relation to the sharing conditions among non-GSO FSS, GSO FSS, GSO broadcasting-satellite service (BSS), space sciences and terrestrial services, to ensure the feasibility of these power limits and that these limits do not impose undue constraints on the development of these systems and services;

1.13.2 to consider the inclusion in other frequency bands of similar limits in Articles S21 and S22, or other regulatory approaches to be applied in relation to sharing situations;

INTRODUCTION

This document contains several categories of draft CITEL Common Proposals on Agenda item 1.13:

- Proposals that are fully agreed and eligible for transmission to the ITU as CITEL common proposals (See proposals ../1.13/ 80-89 on protection of very large earth stations, ../1.13/90-95 on protection of terrestrial services from NGSO FSS, and ../1.13/96 on agenda item 1.13.2),
- Proposals that are agreed but are part of a proposal package that is not yet complete. It is intended that the proposals contained in this category will be supplemented with proposals to be developed at the XV Meeting of PCC.III, and that the complete package would be assembled and transmitted to the ITU upon conclusion of the XV meeting. As a result, these proposals should be treated as having been agreed by the Member States so indicated, but also as not yet final (See proposals ../1.13/55-78 on Section II of Article S22),
- A proposal that is substantially agreed but which has limited numbers of square bracketed items which are an indication to CITEL administrations that further review is needed. A correspondence group has been established to address these items in the interim but the proposal is not expected to be finalized until the XV meeting (See proposal ../1.13/79 on aggregate interference levels).

Proposal for Agenda Item 1.13.1

to review and, if appropriate, revise the power limits appearing in Articles S21 and S22 in relation to the sharing conditions among non-GSO FSS, GSO FSS, GSO broadcasting-satellite service (BSS), space sciences and terrestrial services, to ensure the feasibility of these power limits and that these limits do not impose undue constraints on the development of these systems and services;

Modifications to Section II of Article S22
in relation to the sharing conditions among non-GSO FSS, FSS and GSO BSS services

Background Information: Resolution **130 (WRC-97)** and Resolution **538 (WRC-97)** each requested the ITU-R to conduct (a) “appropriate technical, operational and regulatory studies” to review the regulatory conditions relating to the coexistence of non-GSO FSS and GSO FSS and GSO BSS systems, in order to ensure that undue constraints are not placed on the development of non-GSO FSS, GSO FSS and GSO BSS systems, and (b) the development of a methodology for calculating the power levels produced by non-GSO FSS systems and the compliance of these levels with the applicable limits established pursuant to Resolutions **130** and **538**. Joint Task Group 4-9-11 was established by the ITU-R to pursue these mandates and to determine the necessary technical bases.

At CPM-99-2, a compromise was reached on a number of the key technical criteria that would provide adequate protection to GSO FSS and GSO BSS systems without unduly constraining non-GSO FSS systems. Many of the elements of this compromise are reflected in Chapter 3 of the CPM Report, and are reproduced in the following proposals. The CPM report recognizes, however, that there are other essential elements of the compromise package which have yet to be developed. CITELE should consider advancing proposals for these essential elements of the protection of GSO FSS and GSO BSS systems at its next meeting and its proposals should not be viewed as complete until such time as these additional proposals are included.

Taking into account the work of the ITU-R and CPM-99 on this matter, the following is proposed:

Proposal(s):

ARTICLE S22

Space services¹

Section II – Control of interference to geostationary-satellite systems

../1.13/55

NOC

**S22.2
to
S22.5A**

../1.13/56

SUP

S22.5B

Existing texts from **S22.5C** to **S22.5G**, including **S22.5C.1** and **S22.5D.1**, are proposed to be modified and renumbered as described in the proposed provisions below.

NOC¹ A.S22.1

../1.13/57

MOD S22.5CB

§ 5 1) The equivalent power flux-density², EPFD_{down} at any point on the Earth's surface visible from the geostationary-satellite orbit, produced by emissions from all the space stations of a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table s S22-1, S22-1A to S22-1D, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limits given in Table s S22-1 S22-1A to S22-1D for the given percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified in Table s S22-1 S22-1A to S22-1D, for all pointing directions towards the geostationary-satellite orbit. —(WRC 97)

IAP/1.13/58

MOD

² S22.5CB.1, C.1, D.1 The equivalent power flux-density is defined as the sum of the power flux-densities produced at a GSO receive station point on the Earth's surface or in the geostationary orbit, as appropriate, by all the transmit space stations within a non-geostationary-satellite system, taking into account the off-axis discrimination of a reference receiving antenna assumed to be pointing towards the geostationary satellite orbit in its nominal direction. The equivalent power flux-density is calculated using the following formula:

$$epfd = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_s} 10^{pfd_i/10} \cdot \frac{G_r(\theta_i)}{G_{max}} \right]$$
$$EPFD = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_a} 10^{\frac{P_i}{10}} \cdot \frac{G_t(\theta_i)}{4 \cdot \pi d_i^2} \cdot \frac{G_r(\phi_i)}{G_{r,max}} \right]$$

where:

- N_a is the number of transmit stations in the non-geostationary-satellite system that are visible from the GSO receive station considered on the Earth's surface or in the geostationary orbit, as appropriate;
- i is the index of the transmit station considered in the non-geostationary-satellite system;
- P_i is the RF power at the input of the antenna of the transmit station, considered in the non-geostationary satellite system in dBW in the reference bandwidth;
- θ_i is the off-axis angle between the boresight of the transmit station considered in the non-geostationary satellite system and the direction of the GSO receive station;

TABLE S22-1 (WRC 97)

| Frequency band allocated to the broadcasting-satellite service | Antenna diameter (cm) | Equivalent pfd level (dB(W/m ² /4 kHz)) which may not be exceeded during the percentage of time shown | Reference antenna radiation pattern |
|--|-----------------------|--|-------------------------------------|
|--|-----------------------|--|-------------------------------------|

$G_t(q)$ is the transmit antenna gain (as a ratio) of the station considered in the non-geostationary satellite system in the direction of the GSO receive station;

d_i is the distance in metres between the transmit station considered in the non-geostationary satellite system and the GSO receive station;

f_i is the off-axis angle between the boresight of the antenna of the GSO receive station and the direction of the i th transmit station considered in the non-geostationary satellite system;

$G_r(f_i)$ is the receive antenna gain (as a ratio) of the GSO receive station in the direction of the i th transmit station considered in the non-geostationary satellite system;

$G_{r,max}$ is the maximum gain (as a ratio) of the antenna of the GSO receive station;

$EPFD$ is the computed equivalent power flux-density in dB(W/m²) in the reference bandwidth.

N_s : number of non-geostationary space stations visible from the point considered at the Earth's surface, within an elevation angle greater than or equal to 0°;

i : index of the non-geostationary space station considered;

pfd_i : power flux density produced at the point considered on the Earth's surface in dB(W/m²) in the reference bandwidth;

θ_i : angle between the direction considered towards the geostationary-satellite orbit and the direction of the interfering space station in the non-geostationary satellite system;

$G_r(\theta_i)$: gain (as a ratio) of the receive reference antenna to be considered as part of a geostationary-satellite network;

G_{max} : maximum gain (as a ratio) of the above receive reference antenna;

$epfd$: computed equivalent power flux density in dB(W/m²) in the reference bandwidth.

| | | 99.7% | 100% | |
|--|--|--|--|---|
| 11.7-12.5 GHz in Region 1, 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 | 30 60 90 | -172.3 -183.3 -186.8 | -169.3 -170.3 -170.3 | Recommendation ITU-R BO.1213 |
| 12.2-12.7 GHz in Region 2 | 45 100 120 180 | -174.3 -186.3 -187.9 -191.4 | -165.3 -170.3 -170.3 -170.3 | § 3.7.2 of Annex 5 of Appendix S30 |
| 17.3-17.8 GHz in Region 2 | For further study[‡] | | | |

[‡]—The interference from non-geostationary fixed-satellite service (non-GSO FSS) systems into geostationary broadcasting-satellite service (GSO BSS) systems operating in the frequency bands 17.3-17.8 GHz relates to the two following sharing situations:

- non-GSO FSS transmit earth station into GSO receive earth station;
- GSO BSS transmit space station into non-GSO FSS receive space stations.

Both situations need to be studied, in particular since coexistence of receive BSS earth stations and large numbers of transmit non-GSO FSS terminals would not be feasible within the same country

../1.13/60
ADD

TABLE S22-1A^{1,3}

Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} level may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ² |
|---|--|--|---------------------------|--|
| 10.7-11.7 in all Regions; 11.7-12.2 in Region 2; | -175.4 | 0 | 40 | 60 cm Recommendation S. [4/57] |
| | -174.0 | 90 | | |
| | -170.8 | 99 | | |
| | -165.3 | 99.73 | | |
| | -160.4 | 99.991 | | |
| | -160.0 | 99.997 | | |
| | -160.0 | 100 | | |
| | -181.9 | 0 | 40 | 1.2 m Recommendation S. [4/57] |
| | -178.4 | 99.5 | | |
| | -173.4 | 99.74 | | |
| | -173.0 | 99.857 | | |

| | | | | |
|---|---------|---------|----|------------------------------------|
| 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3 | -164.0 | 99.954 | | |
| | -161.6 | 99.984 | | |
| | -161.4 | 99.991 | | |
| | -160.8 | 99.997 | | |
| | -160.5 | 99.997 | | |
| | -160.0 | 99.9993 | | |
| | -160.0 | 100 | | |
| | -190.45 | 0.00 | 40 | 3 m Recommendation S.[4/57] |
| | -189.45 | 90.00 | | |
| | -187.45 | 99.50 | | |
| | -182.4 | 99.70 | | |
| | -182 | 99.855 | | |
| | -168 | 99.971 | | |
| | -164 | 99.988 | | |
| | -162 | 99.995 | | |
| | -160 | 99.999 | | |
| | -160 | 100000 | | |
| | -195.45 | 0.00 | 40 | 10 m Recommendation S.[4/57] |
| | -195.45 | 99.00 | | |
| | -190.00 | 99.65 | | |
| | -190 | 99.71 | | |
| | -172.5 | 99.99 | | |
| | -160 | 99.998 | | |
| | -160 | 100.000 | | |

¹ For certain receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

³ In addition to the limits shown in Table **S22-1A**, the following single-entry EPFD_{down} limits apply to all antenna sizes greater than 60cm in the frequency bands listed in Table **S22-1A**.

| 100% of the time EPFD _{down} dB(W/(m ² ·40 kHz)) | Latitude (North or South) (°) |
|---|----------------------------------|
| -160 | 0 < \|Latitude\| ≤ 57.5 |
| -160 + 3.4(57.5 - \|Latitude\|)/4 | 57.5 < \|Latitude\| ≤ 63.75 |
| -165.3 | 63.75 ≤ \|Latitude\| |

Reasons: The limits proposed above for the 60 cm and 1.2 m antennas were agreed within the ITU-R. The limits proposed for the 3 m and 10 m antennas represent a compromise agreed upon at the CPM-99 meeting. The compromise package agreed upon consists of the following:

- i) “validation” EPFD_{down} masks for reference GSO FSS earth station antenna diameters of 60 cm, 1.2m, 3 m, and 10 m;
- ii) “operational” EPFD_{down} limits for all antenna diameters between 3 m and 18 m;
- iii) “additional operational” EPFD_{down} limits for antenna diameters of 3 m and 10 m; and
- iv) “validation” EPFD_{down} limits for antenna diameters exceeding 60 cm located at high latitudes.

CPM-99 agreed that “validation” masks, in conjunction with “operational” and “additional operational” limits, as appropriate, would adequately protect GSO FSS systems using 60 cm, 1.2 m, 3 m and 10 m antennas. Table **S22-1A** above contains the limits referred to in items i) and iv) of the compromise package.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in ii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

With regard to the additional operational EPFD_{down} limits in iii), an administration proposing a non-GSO FSS system would have to commit that the proposed system will meet these additional operational limits. A possible mechanism would be the inclusion of a requirement in Appendix **S4**.

In order to implement the additional operational limits, there is a need for procedures to be developed for the same purpose as identified for the operational limits. In particular, a WRC-2000 Resolution calling for ITU-R studies, as a matter of urgency, is required to develop methodologies:

- to determine the time distribution of the actual EPFD levels radiated by a non-GSO FSS system into a 3 to 10 metre GSO FSS antenna;
- to assess interference levels for intermediate antenna sizes;
- to permit administrations to check compliance with the additional operational limits.

../1.13/61
ADD

TABLE S22-1B¹
Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference pattern ² |
|----------------------|--|--|---------------------------|--|
| 17.8-18.6 | -175.4 -175.4 -172.5 -167 -164 -164 | 0 90 99 99.714 99.971 100 | 40 | 1 m Recommendation S.[4/57] |
| | -161.4 -161.4 -158.5 -153 -150 -150 | 0 90 99 99.714 99.971 100 | 1000 | |
| 17.8-18.6 | -178.4 -178.4 -171.4 -170.5 -166 -164 -164 | 0 99.4 99.9 99.913 99.971 99.977 100 | 40 | 2 m Recommendation S.[4/57] |
| | -164.4 -164.4 -157.4 -156.5 -152 -150 -150 | 0 99.4 99.9 99.913 99.971 99.977 100 | 1 000 | |
| 17.8-18.6 | -185.4 -185.4 -180 -180 -172 -164 -164 | 0 99.8 99.8 99.943 99.943 99.998 100 | 40 | 5 m Recommendation S.[4/57] |

| | | | |
|--|--------|--------|-------|
| | -171.4 | 0 | 1 000 |
| | -171.4 | 99.8 | |
| | -166 | 99.8 | |
| | -166 | 99.943 | |
| | -158 | 99.943 | |
| | -150 | 99.998 | |
| | -150 | 100 | |

¹ For certain receive earth stations see also ADD **S9.7A** and ADD **S9.7B**.

² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

Reasons: The EPFD_{down} limits proposed above for the 17.8-18.6 GHz band were agreed within the ITU-R. CPM-99 agreed that the EPFD_{down} validation limits proposed above in conjunction with the operational limits contained in Table **S22-4B** would adequately protect GSO FSS operations. Specification of the EPFD_{down} limits in both a 40 kHz and a 1 MHz reference bandwidth is needed to ensure protection of GSO FSS operations from varying types of non-GSO FSS emissions.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in ii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

../1.13/62
ADD

TABLE S22-1C¹

Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference pattern ² |
|----------------------|--|--|---------------------------|--|
| 19.7-20.2 | -187.4 -182 -172 -154 -154 | 0 71.429 97.143 99.983 100 | 40 | 70 cm Recommendation S. [4/57] |
| | -173.4 -168 -158 -140 -140 | 0 71.429 97.143 99.983 100 | 1 000 | |
| 19.7-20.2 | -190.4 -181.4 -170.4 -168.6 -165 -160 -154 -154 | 0 91 99.8 99.8 99.943 99.943 99.997 100 | 40 | 90 cm Recommendation S.[4/57] |
| | -176.4 -167.4 -156.4 -154.6 -151 -146 -140 -140 | 0 91 99.8 99.8 99.943 99.943 99.997 100 | 1 000 | |
| 19.7-20.2 | -196.4 -162 -154 -154 | 0 99.98 99.99943 100 | 40 | 2.5 m Recommendation S.[4/57] |
| | -182.4 -148 -140 -140 | 0 99.98 99.99943 100 | 1 000 | |

| | | | | |
|-----------|--------|---------|-------|---------------------------------------|
| 19.7-20.2 | -200.4 | 0 | 40 | 5 m Recommend ation S.[4/57] |
| | -189.4 | 90 | | |
| | -187.8 | 94 | | |
| | -184 | 97.143 | | |
| | -175 | 99.886 | | |
| | -164.2 | 99.99 | | |
| | -154.6 | 99.999 | | |
| | -154 | 99.9992 | | |
| | -154 | 100 | | |
| | -186.4 | 0 | 1 000 | |
| | -175.4 | 90 | | |
| | -173.8 | 94 | | |
| | -170 | 97.143 | | |
| | -161 | 99.886 | | |
| | -150.2 | 99.99 | | |
| | -140.6 | 99.999 | | |
| | -140 | 99.9992 | | |
| | -140 | 100 | | |

- ¹ For certain receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.
- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

Reasons: The EPFD_{down} limits proposed above for the 70 cm and 90 cm antennas were agreed within the ITU-R. For the 2.5 m and 5 m antennas, CPM-99 agreed that the EPFD_{down} validation limits proposed above in conjunction with the operational limits contained in Table **S22-4B** would adequately protect GSO FSS operations. Specification of the EPFD_{down} limits in both a 40 kHz and a 1 MHz reference bandwidth is needed to ensure protection of GSO FSS operations from varying types of non-GSO FSS emissions.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in ii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

../1.13/63
ADD

TABLE S22-1D^{2,3}
Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands
30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} level may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ¹ |
|---|--|--|---------------------------|--|
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -165.841 -165.541 -164.041 -158.600 -158.600 -158.330 -158.330 | 0.000 25.000 96.000 98.857 99.429 99.429 100.000 | 40 | 30 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -175.441 -172.441 -169.441 -164.000 -160.750 -160.000 -160.000 | 0.000 66.000 97.750 99.357 99.809 99.986 100.000 | 40 | 45 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -176.441 -173.191 -167.750 -162.000 -161.000 -160.200 -160.000 -160.000 | 0.000 97.800 99.371 99.886 99.943 99.971 99.997 100.000 | 40 | 60 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1] |

| | | | | |
|---|----------|---------|----|--|
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | –178.94 | 0.000 | 40 | 90 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | –178.44 | 33.000 | | |
| | –176.44 | 98.000 | | |
| | –171.00 | 99.429 | | |
| | –165.50 | 99.714 | | |
| | –163.00 | 99.857 | | |
| | –161.00 | 99.943 | | |
| | –160.00 | 99.991 | | |
| | –160.00 | 100.000 | | |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | –182.440 | 0.000 | 40 | 120 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | –180.690 | 90.000 | | |
| | –179.190 | 98.900 | | |
| | –178.440 | 98.900 | | |
| | –174.940 | 99.500 | | |
| | –173.750 | 99.680 | | |
| | –173.000 | 99.680 | | |
| | –169.500 | 99.850 | | |
| | –167.800 | 99.915 | | |
| | –164.000 | 99.940 | | |
| | –161.900 | 99.970 | | |
| | –161.000 | 99.990 | | |
| | –160.400 | 99.998 | | |
| | –160.000 | 100 | | |
| 11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz | –184.941 | 0.000 | 40 | 180 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | –184.101 | 33.000 | | |
| | –181.691 | 98.500 | | |
| | –176.250 | 99.571 | | |
| | –163.250 | 99.946 | | |
| | –161.500 | 99.974 | | |
| | –160.350 | 99.993 | | |

| | | | | |
|-------------------------------|----------|---------|----|--|
| in Region 2 | -160.000 | 99.999 | | |
| | -160.000 | 100.000 | | |
| 11.7-12.5 GHz in Region 1 | -187.441 | 0.000 | | |
| | -186.341 | 33.000 | | |
| 11.7-12.2 GHz and | -183.441 | 99.250 | | |
| | -178.000 | 99.786 | | 240 cm |
| 12.5-12.75 GHz in Region 3 | -164.400 | 99.957 | | DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| 12.2-12.7 GHz in Region 2 | -161.900 | 99.983 | 40 | |
| | -160.500 | 99.994 | | |
| | -160.000 | 99.999 | | |
| | -160.000 | 100.000 | | |
| 11.7-12.5 GHz In Region 1 | -191.941 | 0.000 | | |
| | -189.441 | 33.000 | | |
| 11.7-12.2 GHz and | -185.941 | 99.500 | | |
| 12.5-12.75 GHz In Region 3 | -180.500 | 99.857 | | 300 cm |
| 12.2-12.7 GHz In Region 2 | -173.000 | 99.914 | 40 | DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | -167.000 | 99.951 | | |
| | -162.000 | 99.983 | | |
| | -160.000 | 99.991 | | |
| | -160.000 | 100.000 | | |

- ¹ Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO BSS systems.
- ² For BSS antenna diameters 180 cm, 240 cm and 300 cm, in addition to the single-entry limits shown in Table **S22-1D**, the following single-entry 100% of the time EPFD_{down} limit also applies in the frequency bands listed in Table **S22-1D**:

| 100% of the time EPFD_{down} dB(W/(m²·40 kHz)) | Latitude (North or South) (°) |
|--|--|
| -160.0 | 0 < \|latitude\| ≤ 57.5 |
| -160.0 + 3.4 * (57.5 - \|latitude\|)/4 | 57.5 < \|latitude\| ≤ 63.75 |
| -165.3 | 63.75 ≤ \|latitude\| |

- ³ For BSS antenna diameter 240 cm, in addition to the single-entry 100% of the time EPFD_{down} limit specified in footnote 2 of this Table, a -167 dB(W/(m²·40 kHz)) single-entry 100% of the time operational EPFD_{down} limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing

toward GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with elevation angles greater than 5°. [This limit is implemented during a transition period of [15] years.]*

Reasons: The limits proposed above represent a compromise agreed upon at the CPM-99 meeting consisting of the following:

- i) “validation” EPFD_{down} masks for reference GSO BSS earth station antenna diameters of 30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm, and 300 cm;
- ii) latitude dependent validation 100% of the time EPFD_{down} limits for 180 cm, 240 cm, and 300 cm BSS earth station antennas; and
- iii) “operational” 100% of the time single entry EPFD_{down} limits for 240 cm BSS antenna diameters in a certain northern high latitude area of Region 2.

Table S22-1D above contains the limits referred to in items i), ii) and iii) of the compromise package. The limit in item iii) is required because the power of BSS transmissions that can be radiated toward a certain northern high latitude area of Region 2 is limited by the existing pfd limits contained in section 5c) of Annex 1 to Appendix S30. This leads to the use of larger BSS earth station antennas in this geographical area and more sensitive links. The square brackets around the last sentence in footnote 3 can be removed only if the pfd limits in section 5c of annex 1 to Appendix S30 are sufficiently relaxed as described in section 5.2.3.5 of the CPM report.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in iii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

../1.13/64

MOD

S22.5D 2) The ~~aggregate~~²³ ~~equivalent~~ power flux-density, EPFD_{up}, produced at any point in the geostationary-satellite orbit by emissions from all

* This transitional regime would be applicable only if the pfd limits in section 5c of Annex 1 to Appendix S30 are sufficiently relaxed.

IAP/1.13/66

SUP

²³ ~~**S22.5D.1** The aggregate power flux density is defined as the sum of the power flux densities produced at a point in the geostationary-satellite orbit by all the earth stations of a non-geostationary satellite system. The aggregate power flux density is computed by means of the following formula:~~

$$upfd = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_e} 10^{P_i/10} \cdot \frac{G_t(\theta_i)}{4 \pi d_i^2} \right]$$

~~where:~~

the earth stations in a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table S22-2, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-2 for the specified percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified in Table S22-2, for all pointing directions towards the Earth's surface visible from any given location in the geostationary-satellite orbit.—(WRC 97)

../1.13/65
SUP

~~TABLE S22-2~~ (WRC 97)

| Frequency band (GHz) | Aggregate pfd dB(W/m²/4 kHz) | Percentage of time during which aggregate pfd level may not be exceeded |
|---|--|--|
| 17.3–18.1 in Regions 1 and 3 and 17.8–18.1 in Region 2 | –163 | 100% |

../1.13/67
ADD

TABLE S22-2

Limits to the EPFD_{up} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{up} dB(W/m ²) | Percentage of time during which EPFD _{up} | Reference bandwidth | Reference antenna beamwidth |
|-------------------------|---|--|------------------------|-----------------------------------|
|-------------------------|---|--|------------------------|-----------------------------------|

~~N_e : number of earth stations in the non-geostationary-satellite system with an elevation angle greater than or equal to 0°, from which the point considered in the geostationary-satellite orbit is visible;~~

~~i : index of the earth station considered in the non-geostationary-satellite system;~~

~~P_i : RF power at the input of the transmitting antenna of the earth station considered in the non-geostationary-satellite system in dBW in the reference bandwidth;~~

~~θ_i : off-axis angle between the boresight of the earth station considered in the non-geostationary-satellite system and the direction of the point considered in the geostationary-satellite orbit;~~

~~$G_i(\theta_i)$: transmit antenna gain (as a ratio) of the earth station considered in the non-geostationary-satellite system in the direction of the point considered in the geostationary-satellite orbit;~~

~~d_i : distance in metres between the earth station considered in the non-geostationary-satellite system and the point considered in the geostationary-satellite orbit;~~

~~$apfd$: aggregate power flux density in dB(W/m²) in the reference bandwidth.~~

NOTE Tables S22-1 to S22-4 and Nos. S22.26 to S22.29 contain provisional limits corresponding to an interference level caused by one non-geostationary fixed-satellite service system in the frequency bands to be applied in accordance with Resolutions 130 (WRC 97) and 538 (WRC 97). These provisional limits are subject to review by ITU-R and are subject to confirmation by WRC 99.—(WRC 97)

| | | may not be exceeded | (kHz) | and reference radiation pattern |
|---|------|---------------------|-------|---|
| 12.50 – 12.75 12.75 – 13.25 13.75 – 14.5 | -160 | 100 | 40 | 4 degrees ITU-R S.672, Ls = -20 ¹ |
| 17.3-17.8 Region 1 and Region 3 ² 17.8-18.1 | -160 | 100 | 40 | 4 degrees ITU-R S.672, Ls = -20 ¹ |
| 27.5 – 28.6 | -162 | 100 | 40 | 1.55 degrees ITU-R S.672, Ls = -10 ¹ |
| 29.5 – 30.0 | -162 | 100 | 40 | 1.55 degrees ITU-R S.672, Ls = -10 ¹ |

¹ For the case of Ls=-10, the values a=1.83 and b=6.32 should be used in the equations in Annex 1 of Recommendation ITU-R S.672 for single-feed circular beams. In all cases of Ls, the parabolic main beam equation should start at zero.

² This EPFD_{up} level also applies to the frequency band 17.3-17.8 GHz to protect BSS feeder links in Region 2 from non-GSO FSS Earth-to-space transmissions in Regions 1 and 3.

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SUP

S22.5E

~~3) The equivalent power flux density⁴, at any point on the Earth's surface visible from the geostationary satellite orbit, produced by emissions from all the space stations of a non-geostationary satellite system in the fixed-satellite service in the frequency bands listed in Table S22-3, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-3 for the given percentages of time. These limits relate to the equivalent power flux density which would be obtained under free-space propagation conditions into all the reference antennas and in the reference bandwidths specified in Table S22-3, and for all pointing directions towards the geostationary satellite orbit. (WRC 97)~~

⁴ ~~S22.5E.1 See No. S22.5C.1. (WRC 97)~~

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SUP

TABLE S22-3 (WRC 97)
PART A

| Frequency band (GHz) | Equivalent pfd dB(W/m ²) | Percentage of time during which equivalent pfd level may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern |
|--|--------------------------------------|--|---------------------------|---|
| 10.7-11.7; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3 | -179 | -99.7 | 4 | 60 cm, Rec. ITU-R S.465-5 |
| | -192 | -99.9 | 4 | 3 m, Rec. ITU-R S.465-5 |
| | -186 | -99.97 | 4 | 3 m, Rec. ITU-R S.465-5 |
| | -195 | -99.97 | 4 | 3 m, Rec. ITU-R S.465-5 |
| | -170 | -99.999 | 4 | 10 m, Rec. ITU-R S.465-5 |
| | -173 | -99.999 | 4 | 10 m, Rec. ITU-R S.465-5 |
| | -178 | -99.999 | 4 | 10 m, Rec. ITU-R S.465-5 |
| | -170 | 100 | 4 | 60 cm, Rec. ITU-R S.465-5 |
| | | | | 3 m, Rec. ITU-R S.465-5 |
| | | | | 10 m, Rec. ITU-R S.465-5 |
| | | | | ≥ 60 cm, Rec. ITU-R S.465-5 |

TABLE S22-3 (WRC 97)
PART B

| Frequency band (GHz) | Equivalent pfd dB(W/m ²) | Percentage of time during which equivalent pfd level may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern |
|----------------------|--------------------------------------|--|---------------------------|---|
| 17.8-18.6 | -165 | -99.0 | —40 | 30 cm, Rec. ITU-R S.465-5 |
| | -151 | | 1 000 | |
| | -165 | -99.0 | —40 | 70 cm, Rec. ITU-R S.465-5 |
| | -151 | | 1 000 | |
| | -165 | -99.5 | —40 | 90 cm, Rec. ITU-R S.465-5 |
| | -151 | | 1 000 | |
| | -167 | -99.8 | —40 | 1.5 m, Rec. ITU-R S.465-5 |
| | -153 | | 1 000 | |

| | | | | | |
|-----------|--------------|-------|--------------|--------------------------------------|--|
| | -180 -166 | -99.9 | -40 1 000 | 5 m, Rec. ITU-R S.465-5 | |
| | -184 -170 | -99.9 | -40 1 000 | 7.5 m, Rec. ITU-R S.465-5 | |
| | -188 -174 | -99.9 | -40 1 000 | 12 m, Rec. ITU-R S.465-5 | |
| | -165 -151 | 100 | -40 1 000 | 30 cm to 12 m, Rec. ITU-R S.465-5 | |
| 19.7-20.2 | -154 -140 | -99.9 | -40 1 000 | 30 cm, Rec. ITU-R S.465-5 | |
| | -164 -150 | -99.9 | -40 1 000 | 90 cm, Rec. ITU-R S.465-5 | |
| | -167 -153 | -99.8 | -40 1 000 | 2 m, Rec. ITU-R S.465-5 | |
| | -174 -160 | -99.9 | -40 1 000 | 5 m, Rec. ITU-R S.465-5 | |
| | -154 -140 | 100 | -40 1 000 | 30 cm to 12 m, Rec. ITU-R S.465-5 | |

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MOD

S22.5FD

43) The ~~aggregate-equivalent~~ power flux-density²⁵, EPFD_{is}, produced at any point in the geostationary-satellite orbit by emissions from all the ~~earth space~~ stations in a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table S22-3, including emissions from a ~~reflecting satellite~~, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-43 for ~~the specified any~~ percentage^s of time. These limits relate to the ~~equivalent~~ power flux-density which would be obtained under free-space propagation conditions in ~~to a the~~ reference antenna and in the reference bandwidth specified in Table S22-43, for all pointing directions towards the Earth's surface visible from any given location in the geostationary-satellite orbit. —(WRC-97)

²⁵ — S22.5F.1 — See No. S22.5D.1. — (WRC-97)

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ADD

TABLE S22-3

Limits to the EPFD_{is} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{is} dB(W/m ²) | Percentage of time EPFD _{is} level may not be exceeded | Reference bandwidth (kHz) | Reference antenna beamwidth and reference radiation pattern ¹ |
|--|--|---|---------------------------|--|
| 10.7-11.7 (Region 1) 12.5-12.75 (Region 1) 12.7-12.75 (Region 2) | -160 | 100 | 40 | 4 degrees ITU-R S.672, Ls = -20 |
| 17.8-18.4 | -160 | 100 | 40 | 4 degrees ITU-R S.672, Ls = -20 |

¹ Under this Section, this reference pattern is to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

../1.13/72
SUP

~~TABLE S22-4 (WRC 97)~~
~~PART A~~

| Frequency band (GHz) | Aggregate pfd dB(W/m²) | Percentage of time during which aggregate pfd level may not be exceeded | Reference bandwidth (kHz) | |
|---------------------------------|--|--|--------------------------------------|--|
| 12.5-12.75 | -170 | 100 | 4 | |
| 12.75-13.25 | -186 | 100 | 4 | |
| 13.75-14.5 | -170 | 100 | 4 | |

TABLE ~~S22-4~~ (WRC 97)

PART B

| Frequency band (GHz) | Aggregate pfd dB(W/m ²) | Percentage of time during which aggregate pfd level may not be exceeded | Reference bandwidth (kHz) |
|--------------------------|--|--|------------------------------|
| 27.5–28.6 and | –159 | 100 | 40 |
| 29.5–30 | –145 | 100 | 1 000 |

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MOD

S22.5 ~~GE~~

The limits given in Tables ~~S22-1A to S22-1D~~ and ~~S22-3~~ may be exceeded on the territory of any country whose administration has so agreed. ~~(WRC 97)~~

../1.13/74

ADD

S22.5 F

The limits specified in No. **S22.5B** to **S22.5D** apply to non-GSO FSS systems for which complete coordination or notification information, as appropriate, has been received after 22 November 1997.

Reasons: Reflect the "*instructs the Radiocommunication Bureau*" in Resolutions 130 (WRC-97) and 538 (WRC-97), and *resolves* 2 of Resolution 130 (WRC-97). Review of the findings by the Bureau under "*instructs the Radiocommunication Bureau*" in Resolution 130 (WRC-97) and Resolution 538 (WRC-97) should be kept in an updated version of these resolutions to cover transitional aspects. It was noted that no notification was received prior to 22 November 1997 for non-GSO FSS systems (Earth-to-space) in the bands 17.3–18.1 GHz (Regions 1 and 3) and 17.8–18.1 GHz (Region 2).

../1.13/75

ADD

S22.5 G

An administration operating a non-GSO FSS system which is in compliance with the limits in No. **S22.5B** to **S22.5D** (see also Resolution **WWW**) shall be considered as having fulfilled its obligations under No. **S22.2** with respect to any GSO network, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO system and of the complete coordination information for the GSO network, provided that the EPFD_{down} radiated by the non-GSO FSS system into any operating GSO FSS earth station does not exceed the operational limits given in footnote 3 of Table **S22-1D** or the operational limits given in Tables **S22-4A** and **S22-4B**, when the diameter of the earth station is equal to the values given in Table **S22-4A** or the gain of the earth station is equal to or greater than the values given in Table **S22-4B** for the corresponding orbital inclination of the GSO FSS satellite. Except as otherwise agreed between concerned administrations, an administration operating a non-GSO FSS system that is subject to the limits in No. **S22.5B** to **S22.5D** and which radiates EPFD_{down} into any operating GSO FSS earth station at levels in excess of the operational limits given in footnote 3 of Table **S22-1D** or the operational limits given in Tables **S22-4A** and **S22-4B**, when the diameter of the earth station is equal to the values given in Table **S22-4A** or the gain of the earth station is equal to or greater than the values given in Table **S22-4B** for the

corresponding orbital inclination of the GSO FSS satellite, shall be considered in violation of its obligations under No. **S22.2**.

Reasons: Reflects *resolves* 4 and 1.4 of Resolutions 130 (WRC-97) and 538 (WRC-97), and the principles provided in section 3.1.2.1.4.2 c). Other additions to the provision correct the language, and make explicit the intention that any non-GSO FSS system that exceeds the validation, operational or additional operational limits, as applicable, shall, except otherwise agreed between concerned administrations be deemed to be in violation of its obligations under No. **S22.2**.

../1.13/76
ADD

TABLE **S22-4A**^{1,3}

Operational limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Receive GSO earth station antenna diameter ² (m) | Orbital inclination of GSO satellite (degrees) |
|--|--|--|---------------------------|---|--|
| 10.7-11.7 in all Regions; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3; and 12.5-12.75 in Regions 1 and 3 (prior to 31 December 2005) | -163 -166 -167.5 -169.5 | 100 | 40 | 3 6 9 ≥18 | ≤2.5 |
| | -160 -163 -164.5 -166.5 | 100 | 40 | 3 6 9 ≥18 | ≤4.5 |
| 10.7-11.7 in all Regions; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3; and 12.5-12.75 in Regions 1 and 3 (after 31 December 2005) | -161.25 -164 -165.5 -167.5 | 100 | 40 | 3 6 9 ≥18 | ≤2.5 |
| | -158.25 -161 -162.5 -164.5 | 100 | 40 | 3 6 9 ≥18 | ≤4.5 |

¹ For certain receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

² Linear interpolation of EPFD levels in decibels should be performed for other intermediate antenna diameters using a logarithmic scale for the antenna diameter.

³ In addition to the operational limits shown in Table **S22-4A**, the following additional operational limits apply to certain GSO FSS earth station antenna sizes in the frequency bands listed in Table **S22-4A**. A method of assessing interference levels for intermediate antenna sizes should also be developed within the ITU-R.

| EPFD _{down} (dB(W/(m ² /40 kHz))) | Percentage of time during which EPFD _{down} may be exceeded | Receive GSO earth station antenna diameter (m) |
|--|--|---|
| -182 | 0.1 | 3 |
| -179 | 0.06 | |
| -176 | 0.03 | |
| -171 | 0.02 | |
| -168 | 0.016 | |
| -165 | 0.007 | |
| -163 | 0.001 | |
| -161.25 | 0.00025 | |
| -161.25 | 0 | |
| -185 | 0.03 | 10 |
| -183 | 0.02 | |
| -179 | 0.01 | |
| -175 | 0.004 | |
| -171 | 0.002 | |
| -168 | 0.001 | |
| -166 | 0.0002 | |
| -166 | 0 | |

Reasons: The operational limits proposed for antennas equal to or greater than 3 m in diameter represent a compromise agreed upon at the CPM-99 meeting. The compromise package agreed upon consists of the following:

- i) “validation” EPFD_{down} masks for reference GSO FSS earth station antenna diameters of 60 cm, 1.2m, 3 m, and 10 m;
- ii) “operational” EPFD_{down} limits for all antenna diameters between 3 m and 18 m;
- iii) “additional operational” EPFD_{down} limits for antenna diameters of 3 m and 10 m; and
- iv) “validation” EPFD_{down} limits for antenna diameters exceeding 60 cm located at high latitudes.

CPM-99 agreed that “validation” masks, in conjunction with “operational” and “additional operational” limits, as appropriate, would adequately protect GSO FSS systems using 60 cm, 1.2 m, 3 m and 10 m antennas. Table **S22-4A** contains the limits referred to in items ii) and iii) of the compromise package.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in ii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

With regard to the additional operational EPFD_{down} limits in iii), an administration proposing a non-GSO FSS system would have to commit that the proposed system will meet these additional operational limits. A possible mechanism would be the inclusion of a requirement in Appendix S4.

In order to implement the additional operational limits, there is a need for procedures to be developed for the same purpose as identified for the operational limits. In particular, a WRC-2000 Resolution calling for ITU-R studies, as a matter of urgency, is required to develop methodologies:

- to determine the time distribution of the actual EPFD levels radiated by a non-GSO FSS system into a 3 to 10 metre GSO FSS antenna;
- to assess interference levels for intermediate antenna sizes;
- to permit administrations to check compliance with the additional operational limits.

../1.13/77
ADD

TABLE S22-4B¹
Operational limits to the EPFD_{down} radiated by non-GSO FSS
systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Receive GSO earth station antenna Gain (dBi) | Orbital inclination of GSO satellite (degrees) |
|-------------------------|---|---|---------------------------------|---|--|
| 19.7–20.2 | –157 | 100 | 40 | ≥49 | ≤2.5 |
| | –157 | 100 | 40 | ≥43 ² | ≤2.5 |
| | –155 | 100 | 40 | ≥49 | >2.5 and ≤4.5 |
| 19.7–20.2 | –143 | 100 | 1 000 | ≥49 | ≤2.5 |
| | –143 | 100 | 1 000 | ≥43 ² | ≤2.5 |
| | –141 | 100 | 1 000 | ≥49 | >2.5 and ≤4.5 |
| 17.8–18.6 | –164 | 100 | 40 | ≥49 | ≤2.5 |
| | –162 | 100 | 40 | ≥49 | >2.5 and ≤4.5 |
| 17.8–18.6 | –150 | 100 | 1 000 | ≥49 | ≤2.5 |
| | –148 | 100 | 1 000 | ≥49 | >2.5 and ≤4.5 |

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

² The operational limit applies to non-GSO systems operating at altitudes of 7 000 km or above in order to protect GSO FSS systems employing adaptive coding.

Reasons: The operational limits proposed for antennas with a gain equal to or greater than 49 dBi represent a compromise agreed upon at the CPM-99 meeting. CPM-99 agreed that the “operational” limits contained in Table S22-4B above in conjunction with EPFD_{down} “validation” masks would adequately protect GSO FSS systems with an antenna gain equal to or greater than 49 dBi.

The compromise package includes the following elements which have yet to be developed.

With regard to the operational EPFD_{down} limits in ii), there is a need for regulatory procedures to implement operational limits which: identifies non-GSO systems exceeding the operational limits; and ensures immediate reduction of the interference level to the operational limits by any non-GSO system exceeding those limits. There is a need for a resolution calling for the ITU-R to develop, as a matter of urgency, Recommendations to permit administrations to check compliance with the operational limits.

../1.13/78

ADD

S22.5H

In case of *force majeure*, telecommand and ranging carriers transmitted to non-geostationary satellites in the fixed-satellite service are not subject to the limits given in Table **S22-2**.

Reasons: Specific provision needed to cover emergency situations.

Proposal for the Protection of GSO FSS and GSO BSS networks from the maximum aggregate equivalent power flux-density produced by multiple non-GSO FSS systems in frequency bands where EPFD limits have been adopted

Background Information: The ITU-R and CPM-99 agreed that “[t]here is a need to provide a regulatory mechanism that would ensure protection of GSO FSS and GSO BSS networks from the maximum aggregate equivalent power flux-density produced by multiple non-GSO FSS systems in frequency bands where equivalent power flux-density (EPFD) limits have been adopted.” CPM-99 Report at Section 3.1.1.3.2. With respect specifically to the GSO BSS, Section 3.1.3.1.4(b) of the CPM-99 Report to WRC-2000 states that “[t]here is a need to ensure that the aggregate EPFD produced by all co-frequency non-GSO FSS systems does not exceed the maximum interference levels, as determined by the agreed to aggregate EPFD masks, that are necessary to protect these GSO BSS systems.” This agreement can be implemented by including aggregate EPFD_{down} limits in Article **S22** or annexed to a WRC-2000 Resolution. Such a Resolution is proposed below based on the agreement reached within the ITU-R.

Because it was agreed that single-entry EPFD_{down} “validation” masks in conjunction with “operational” and “additional operational” EPFD_{down} limits would be needed to adequately protect certain GSO FSS antennas in the 10.7-12.75 GHz range, it may be necessary to revisit the aggregate values proposed for the 3m and 10 m GSO antenna sizes in Table WWW-1A in order to ensure that the intended level of protection is provided. For now, the values for these antenna sizes are included in square brackets; CITELE should revisit these values, in order to provide additional detail (either to remove the square brackets or make alternative proposals) in a forthcoming proposal to WRC-2000. Similarly, there might be a need to consider revising the 100% of the time aggregate limits in other frequency bands for the same reasons.

Proposal(s):

../1.13/79

ADD

RESOLUTION WWW (WRC-2000)

**PROTECTION OF GSO FSS AND GSO BSS NETWORKS FROM THE
MAXIMUM AGGREGATE EQUIVALENT
POWER FLUX-DENSITY PRODUCED BY MULTIPLE NON-GSO FSS
SYSTEMS IN
FREQUENCY BANDS WHERE EPFD LIMITS HAVE BEEN ADOPTED**

The World Radiocommunication Conference (Istanbul, 2000),

Considering

- a) that WRC-97 has adopted, in Article **S22**, provisional EPFD limits to be met by non-GSO FSS systems in order to protect GSO FSS and GSO BSS networks in parts of the frequency range 10.7-30 GHz;
- b) that WRC-2000 has revised these limits to ensure that they provide adequate protection to GSO systems without causing undue constraints to any of the systems and services sharing these frequency bands;
- c) that Article **S22** includes single entry EPFD limits which apply to non-GSO FSS systems in these bands;

- d) that these single-entry limits have been derived from aggregate equivalent power flux-density (EPFD) masks that are intended to protect GSO networks, assuming a maximum effective number of non-GSO FSS systems of 3.5;
- e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these bands into GSO FSS systems should not exceed the maximum interference levels that are necessary to protect these GSO systems;
- f) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in these bands are to coordinate the use of these frequencies between themselves under the provisions of No. **S9.12** of the Radio Regulations;
- g) that the orbital characteristics of such systems are likely to be inhomogeneous;
- h) that as a result of this likely inhomogeneity, the aggregate EPFD levels from multiple non-GSO FSS systems are not directly related to the number of actual systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;
- i) that the possible misapplication of single entry limits should be avoided,

recognizing

- a) that non-GSO FSS systems are likely to need to implement interference mitigation techniques to share frequencies among themselves;
- b) that because the use of such interference mitigation techniques will likely keep the number of non-GSO systems small, the aggregate interference caused by non-GSO FSS systems into GSO systems will also likely be small;
- c) that notwithstanding *considering d)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Annex 1;
- d) that administrations operating GSO systems may wish to ensure that the aggregate EPFD produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Annex 1,

resolves

- 1 that administrations operating or planning to operate non-GSO FSS systems in the frequency bands referred to in *considering a)* above, individually or in collaboration, take all possible steps, including by means of appropriate modifications to their systems if necessary, to ensure that the actual aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not exceed the aggregate power levels shown in Annex 1;
- 2 that, in the event that the aggregate interference levels in Annex 1 are exceeded into an operational GSO earth station, administrations operating non-GSO FSS systems in these frequency bands shall expeditiously take all necessary measures to reduce the aggregate EPFD levels to those in Annex 1 or to reduce such interference to higher levels that are acceptable to the affected GSO administration,

requests ITU-R

- 1 to develop, as a matter of urgency, and complete, in time for consideration by the next WRC, a methodology for calculating the aggregate EPFD produced by all non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands

referred to in *considering a)* above into GSO FSS and GSO BSS networks and for comparing the calculated levels with the aggregate power levels shown in Annex 1;
2 to continue its studies on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above in order to assist the administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate EPFD levels produced by their systems into GSO networks,

requests the Director of the Radiocommunication Bureau

to assist in the development of the methodology referred to in *requests ITU-R 1* above.

ANNEX 1 (TO RESOLUTION WWW)

This Annex to Resolution WWW contains tables of aggregate interference levels from multiple non-GSO FSS systems, which individually meet the Table S22-1A limits, into GSO FSS and GSO BSS systems.

TABLE WWW-1A^{1,3}

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ² |
|---|--|--|---------------------------|--|
| 10.7-11.7 in all Regions; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3 | -170.0 | 0 | 40 | 60 cm Recommendation S.[4/57] |
| | -168.6 | 90 | | |
| | -165.3 | 99 | | |
| | -160.4 | 99.97 | | |
| | -160.0 | 99.99 | | |
| | -160.0 | 100 | | |
| | -176.5 | 0 | 40 | 1.2 m Recommendation S.[4/57] |
| | -173.0 | 99.5 | | |
| | -164.0 | 99.84 | | |
| | -161.6 | 99.945 | | |
| | -161.4 | 99.97 | | |
| | -160.8 | 99.99 | | |
| | -160.5 | 99.99 | | |
| | -160 | 99.9975 | | |
| | -160 | 100 | | |
| | [-185 | 0 | 40 | 3 m Recommendation S.[4/57] |
| | -184 | 90 | | |
| | -182 | 99.5 | | |
| | -168 | 99.9 | | |
| | -164 | 99.96 | | |
| | -162 | 99.982 | | |
| | -160 | 99.997 | | |

| | | | | |
|--|-------|--------|----|----------------|
| | -160] | 100.00 | | |
| | [-190 | 0 | 40 | 10 m |
| | -190 | 99 | | Recommendation |
| | -166 | 99.99 | | S.[4/57] |
| | -160 | 99.998 | | |
| | -160] | 100 | | |

- 1 For certain receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.
- 2 Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.
- 3 In addition to the limits shown in Table **WWW-1A**, the following aggregate EPFD_{down} limits apply to all antenna sizes greater than 60 cm in the frequency bands listed in Table **WWW-1A**.

| 100% of the time EPFD _{down} dB(W/(m ² ·40 kHz)) | Latitude (North or South) (°) |
|---|---------------------------------------|
| -160 | $0 < \text{Latitude} \leq 57.5$ |
| $-160 + 3.4(57.5 - \text{Latitude})/4$ | $57.5 < \text{Latitude} \leq 63.75$ |
| -165.3 | $63.75 \leq \text{Latitude} $ |

TABLE WWW-1B¹

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ² | |
|----------------------|--|--|---------------------------|--|-------|
| 17.8-18.6 | −170 | 0 | 40 | 1 m Recommendation S.[4/57] | |
| | −170 | 90 | | | |
| | −164 | 99.9 | | | |
| | −164 | 100 | | | |
| | | −156 | 0 | | 1 000 |
| | | −156 | 90 | | |
| | | −150 | 99.9 | | |
| | | −150 | 100 | | |
| 17.8-18.6 | −173 | 0 | 40 | 2 m Recommendation S.[4/57] | |
| | −173 | 99.4 | | | |
| | −166 | 99.9 | | | |
| | −164 | 99.92 | | | |
| | −164 | 100 | | | |
| | | −159 | 0 | | 1 000 |
| | | −159 | 99.4 | | |
| | | −152 | 99.9 | | |
| | | −150 | 99.92 | | |
| | | −150 | 100 | | |
| 17.8-18.6 | −180 | 0 | 40 | 5 m Recommendation S.[4/57] | |
| | −180 | 99.8 | | | |
| | −172 | 99.8 | | | |
| | −164 | 99.992 | | | |
| | −164 | 100 | | | |
| | | −166 | 0 | | 1 000 |
| | | −166 | 99.8 | | |
| | | −158 | 99.8 | | |
| | | −150 | 99.992 | | |
| | | −150 | 100 | | |

¹ For certain receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

TABLE WWW-1C¹

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ² |
|----------------------|--|--|---------------------------|--|
| 19.7-20.2 | -182 | 0 | 40 | 70 cm Recommendation S.[4/57] |
| | -172 | 90 | | |
| | -154 | 99.94 | | |
| | -154 | 100 | | |
| | -168 | 0 | 1 000 | |
| | -158 | 90 | | |
| | -140 | 99.94 | | |
| | -140 | 100 | | |
| 19.7-20.2 | -185 | 0 | 40 | 90 cm Recommendation S.[4/57] |
| | -176 | 91 | | |
| | -165 | 99.8 | | |
| | -160 | 99.8 | | |
| | -154 | 99.99 | | |
| | -154 | 100 | | |
| | -171 | 0 | 1 000 | |
| | -162 | 91 | | |
| | -151 | 99.8 | | |
| | -146 | 99.8 | | |
| | -140 | 99.99 | | |
| | -140 | 100 | | |
| 19.7-20.2 | -191 | 0 | 40 | 2.5 m Recommendation S.[4/57] |
| | -162 | 99.933 | | |
| | -154 | 99.998 | | |
| | [-154] | 100 | | |
| | -177 | 0 | 1 000 | |
| | -148 | 99.933 | | |
| | -140 | 99.998 | | |
| | [-140] | 100 | | |
| 19.7-20.2 | -195 | 0 | 40 | 5 m Recommendation S.[4/57] |
| | -184 | 90 | | |
| | -175 | 99.6 | | |
| | -161 | 99.984 | | |
| | -154 | 99.9992 | | |
| | [-154] | 100 | | |
| | -181 | 0 | 1 000 | |
| | -170 | 90 | | |
| | -161 | 99.6 | | |
| | -147 | 99.984 | | |
| | -140 | 99.9992 | | |
| | [-140] | 100 | | |

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

TABLE WWW-1D^{2,3}

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands into 30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

| Frequency band (GHz) | EPFD _{down} dB(W/m ²) | Percentage of time during which EPFD _{down} level may not be exceeded | Reference bandwidth (kHz) | Reference antenna diameter, and reference radiation pattern ¹ |
|--|--|--|---------------------------|--|
| 11.7- 12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -160.400 -160.100 -158.600 -158.600 -158.330 -158.330 | 0.000 25.000 96.000 98.000 98.000 100.000 | 40 | 30 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -170.000 -167.000 -164.000 -160.750 -160.000 -160.000 | 0.000 66.000 97.750 99.330 99.950 100.000 | 40 | 45 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -171.000 -168.750 -167.750 -162.000 -161.000 -160.200 -160.000 -160.000 | 0.000 90.000 97.800 99.600 99.800 99.900 99.990 100.000 | 40 | 60 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |

| | | | | |
|---|--------------------------------------|--------------------------------|----|--|
| 11.7-12.5 GHz In Region 1 | -173.75 -173 -171 | 0.000 33.000 98.000 | 40 | 90 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 | -165.5 -163 -161 | 99.100 99.500 99.800 | | |
| 12.2-12.7 GHz In Region 2 | -160 -160.000 | 99.970 100.000 | | |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -177.000 | 0.000 | 40 | 120 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | -175.250 | 90.000 | | |
| | -173.750 | 98.900 | | |
| | -173.000 | 98.900 | | |
| | -169.500 | 99.500 | | |
| | -167.800 | 99.700 | | |
| | -164.000 | 99.820 | | |
| | -161.900 | 99.900 | | |
| | -161.000 | 99.965 | | |
| | -160.400 | 99.993 | | |
| | -160.000 | 100 | | |
| 11.7-12.5 GHz in Region 1 | -179.500 -178.660 -176.250 | 0.000 33.000 98.500 | 40 | 180 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 | -163.250 -161.500 -160.350 | 99.810 99.910 99.975 | | |
| 12.2-12.7 GHz in Region 2 | -160.000 -160.000 | 99.995 100.000 | | |

| | | | | |
|---|----------|---------|----|--|
| 11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2 | -182.000 | 0.000 | 40 | 240 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | -180.900 | 33.000 | | |
| | -178.000 | 99.250 | | |
| | -164.400 | 99.850 | | |
| | -161.900 | 99.940 | | |
| | -160.500 | 99.980 | | |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -160.000 | 99.995 | 40 | 300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | -160.000 | 100.000 | | |
| | -186.500 | 0.000 | | |
| | -184.000 | 33.000 | | |
| | -180.500 | 99.500 | | |
| | -173.000 | 99.700 | | |
| 11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2 | -167.000 | 99.830 | 40 | 300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1] |
| | -162.000 | 99.940 | | |
| | -160.000 | 99.970 | | |
| | -160.000 | 100.000 | | |
| | -160.000 | 100.000 | | |
| | -160.000 | 100.000 | | |

- 1 Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO BSS systems.
- 2 For BSS antenna diameters 180 cm, 240 cm and 300 cm, in addition to the aggregate limit shown in Table **WWW-1D**, the following aggregate 100% of the time EPFD_{down} limit also applies:

| 100% of the time EPFD _{down} dB(W/(m ² ·40 kHz)) | Latitude (North or South) (°) |
|---|---------------------------------------|
| -160.0 | $0 < \text{latitude} \leq 57.5$ |
| $-160.0 + 3.4 * (57.5 - \text{latitude})/4$ | $57.5 < \text{latitude} \leq 63.75$ |
| -165.3 | $63.75 \leq \text{latitude} $ |

- 3 For BSS antenna diameter 240 cm, in addition to the aggregate 100% of the time EPFD_{down} limit specified in footnote 2 of this table, a -167 dB(W/(m²·40 kHz)) aggregate 100% of the time operational EPFD_{down} limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing toward GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with

elevation angles greater than 5°. [This limit is implemented during a transition period of [15] years.]*

Reasons: The ITU-R agreed that there is a need to provide a regulatory mechanism that would ensure protection of GSO FSS and GSO BSS networks from the maximum aggregate equivalent power flux-density produced by multiple non-GSO FSS systems in frequency bands where EPFD_{down} limits have been adopted. See Section 3.1.1.3.2 of Draft CPM Report to WRC-2000. The aggregate limits contained in Tables WWW-1A to WWW-1D above are related to the single entry validation limits proposed in Tables **S22-1A** to **S22-1D** using the conversion methodology and conversion factor of 3.5, both agreed upon within the ITU-R.

Because it was agreed that single-entry EPFD_{down} “validation” masks in conjunction with “operational” and “additional operational” EPFD_{down} limits would be needed to adequately protect certain GSO FSS antennas in the 10.7-12.75 GHz range, it may be necessary to revisit the aggregate values proposed for the 3m and 10 m GSO antenna sizes in Table WWW-1A in order to ensure that the intended level of protection is provided. For now, the values for these antenna sizes are included in square brackets; CITEL should revisit these values, in order to provide additional detail (either to remove the square brackets or make alternative proposals) in a forthcoming proposal to WRC-2000. Similarly, there might be a need to consider revising the 100% of the time aggregate limits in other frequency bands for the same reasons.

The square brackets around the last sentence in footnote 3 of Table WWW-1D can be removed only if the pfd limits in section 5c of annex 1 to Appendix S30 are sufficiently relaxed as described in section 5.2.3.5 of the CPM report.

* This transitional regime would be applicable only if the pfd limits in section 5c of Annex 1 to Appendix **S30** are sufficiently relaxed.

1.13 on the basis of the results of the studies in accordance with Resolutions **130 (WRC-97)**, **131 (WRC-97)** and **538 (WRC-97)**:

1.13.1 to review and, if appropriate, revise the power limits appearing in Articles **S21** and **S22** in relation to the sharing conditions among non-GSO FSS, GSO FSS, GSO broadcasting-satellite service (BSS), space sciences and terrestrial services, to ensure the feasibility of these power limits and that these limits do not impose undue constraints on the development of these systems and services;

1.13.2 to consider the inclusion in other frequency bands of similar limits in Articles **S21** and **S22**, or other regulatory approaches to be applied in relation to sharing situations;

Additions and/or Modifications to Articles S9, S11, S22 and Appendices S4 and S5
to require coordination between NGSO FSS transmitting space stations
and GSO receive earth stations with very large antenna

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Colombia], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Ecuador, United States

Background Information: WRC-97 adopted provisional power flux density limits in certain frequency bands which would apply to non-GSO FSS systems to protect GSO FSS networks, and GSO BSS networks. Resolution **130 (WRC-97)**, *Use of Non-Geostationary Systems in the Fixed-Satellite Service in Certain Frequency Bands*, and Article **S22** of the Radio Regulations contain limits corresponding to an interference level caused by one non-GSO system in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz, and 19.7-20.2 GHz. Studies demonstrate that neither the WRC-97 provisional EPFD_{down} limits and associated percentages of time nor the proposed modifications agreed during ITU-R studies adequately protect existing GSO FSS networks with very large earth station antennas. Section 3.1.2 of the draft CPM report for WRC-2000 concludes that transmissions to earth stations with very large antennas need to be protected and that an additional regulatory procedure would be necessary. Coordination triggers based on the characteristics of the satellite network using the GSO were agreed by the ITU-R and confirmed by CPM-99. In addition to the GSO network triggers, it was decided to include the condition of the EPFD_{down} radiated by the non-GSO FSS system. The CPM99-2 decided that two values would be needed in each band and that exceeding either EPFD_{down} value would trigger coordination. One of the two values in each band was determined by CPM99-2; the second value is being developed based upon section 3.1.2.1.2 e) of the CPM Report, which states that the EPFD_{down} threshold criteria would be sufficiently conservative to trigger coordination. Annex 3 to Chapter 3 of the CPM Report contains example regulatory and procedural text. Building on the CPM report text, this proposal includes additions and/or modifications to Articles **S9** and **S22** and Appendices **S4** and **S5** to require coordination between non-GSO FSS transmitting space stations and GSO receive earth stations with very large earth station antennas.

Proposal(s):

ARTICLE S9

Sub-Section IIA – Requirement and request for coordination

| | | |
|-------------------|------------------------------------|--|
| ../1.13/80 | | |
| ADD | S9.7A | <i>a1)</i> ^{12, 13} for a specific earth station within a geostationary-satellite network in the fixed-satellite service in certain frequency bands in respect of a non-geostationary-satellite system in the fixed-satellite service; |
| ../1.13/81 | | |
| ADD | S9.7B | <i>a2)</i> ^{12, 13} for a non-geostationary-satellite system in the fixed-satellite service in certain frequency bands in respect of a specific earth station within a geostationary-satellite network in the fixed-satellite service; |
| ../1.13/82 | | |
| ADD | S9.7A.1 and S9.7B.1 | ¹² The coordination of a specific earth station under S9.7A or S9.7B shall remain within the authority of the administration having this station located on its territory. |
| ../1.13/83 | | |
| ADD | S9.7A.2 and S9.7B.2 | ¹³ Coordination information relating to a specific earth station received by the Bureau prior to [date to be established by WRC-2000] is considered as complete S9.7A or S9.7B information from the date of receipt of complete information of the associated satellite network under S9.7 provided that the characteristics of the specific earth stations are within the parameters of any typical earth station included in the GSO FSS network coordination request. |
| ../1.13/84 | | |
| MOD | S9.8.1 and S9.9.1 | ¹²¹⁴ Application of this provision with respect to Articles 6 and 7 of Appendices S30 and S30A is suspended pending a decision of WRC- 2000 99 on the revision of these two Appendices. |

Reasons: GSO FSS earth stations with very large antennas are not adequately protected by the EPFD_{down} limits contained in Tables ADD **S22-1A** to **S22-1C** and case-by-case coordination of systems operating co-frequency, co-directional links in the space-to-Earth direction would then be required. The proposed ADD **S9.7A** and ADD **S9.7B** would require coordination between non-GSO FSS transmit satellites and GSO FSS receive earth stations with very large antennas. Proposals **1.13/5, 6, 7, 23, and 24 (XX)** include footnotes referencing ADD **S9.7A** and ADD **S9.7B** to Tables **S22-1A, S22-1B, S22-1C, S22-4A, S22-4B**, respectively. By referring to coordination provisions under **S9.7A** and **S9.7B**, the request for coordination would be sent by the requesting administration to the Bureau under **S9.30**. The Bureau would act under **S9.34** to identify administrations with which coordination may need to be effected and publish the information in the Weekly Circular. Since coordination between a non-GSO FSS space station and very large GSO FSS earth stations is a new type of coordination that does not currently exist in Article **S9**, it is necessary to add two new entry points in Article **S9**:

- One entry point to enable the non-GSO space station administration to request coordination with administrations having specific very large earth station antennas located on their territory.
- Another entry point to enable the reciprocal coordination to take place, i.e. the possibility for an administration planning to implement a specific very large GSO earth station stations located on their territory to request coordination with administrations having non-GSO FSS transmit space stations.

ARTICLE S11

Section II – Examination of notices and recording of frequency assignments in the Master Register

../1.13/85

MOD S11.32A

c) with respect to the probability of harmful interference that may be caused to or by assignments recorded with a favourable finding under Nos. **S11.36** and **S11.37** or **S11.38**, or recorded in application of No. **S11.41**, or published under Nos. **S9.38** or **S9.58** but not yet notified, as appropriate, for those cases for which the notifying administration states that the procedure for coordination under Nos. **S9.7**, **S9.7A** or **S9.7B** could not be successfully completed (see also No. **S9.65**);¹⁰ or

../1.13/86

MOD S11.32A.1

¹⁰ The examination of such notices with respect to any other frequency assignment for which a request for coordination under Nos. **S9.7**, **S9.7A** or **S9.7B** has been published under No. **S9.38** but not yet notified shall be effected by the Bureau in the order of their publication under the same number using the most recent information available.

Reasons: The insertion of a coordination trigger related to EPFD_{down} level radiated by the non-GSO FSS system into the earth station employing the very large antenna considered when this earth station is pointed to the wanted GSO satellite provides a mechanism to examine the notice with respect to the probability of harmful interference that may be caused to or by above-listed assignments, and therefore S11.38 and S11.41 are applicable.

MOD TO APPENDIX S4

ANNEX 2B (TO APPENDIX S4)

Table of characteristics to be submitted for space and radio astronomy services

The required characteristics for coordinating specific very large GSO earth stations with non-GSO FSS transmit space stations could be items for "Notification or coordination of a GSO network (including Appendix **S30B**)" or "Notification or coordination of an earth station."

(The modifications in either column two or column three need to be incorporated into the full table.)

C – Characteristics to be provided for each group of frequency assignments for a satellite antenna beam or an earth station antenna

../1.13/87
MOD

| Items in Appendix | Notification or coordination of a GSO network (including Appendix S30B) | Notification or coordination of an earth station |
|-------------------|---|--|
| C.1 | | |
| C.2.a | X | X |
| C.2.b | | |
| C.3.a | X | X |
| C.3.b | | |
| C.4 | X | X |
| C.5a | X | |
| C.5.b | | |
| C.5.c | | |
| C.6 | X | X |
| C.7.a | X ⁹ | X ⁹ |
| C.7.b | C ⁹ | C ⁹ |
| C.7.c | C ⁹ | C ⁹ |
| C.7.d | C | C |
| C.8.a | X ⁷ | C ⁸ |
| C.8.b | X ⁷ | X ⁷ |
| C.8.c | X ⁶ | X ⁶ |
| C.8.d | X ² | |
| C.8.e | X ⁶ | X ⁶ |
| C.8.f | | |
| C.8.g | C ⁴ | C ^{4,5} |
| C.8.h | | |
| C.8.i | | |
| C.8.j | | |
| C.9.a | C | |
| C.9.b | | |
| C.9.c | | |
| C.10.a | X ² | C ⁹ |
| C.10.b | X ⁹ | C ⁹ |
| C.10.c.1 | X ⁹ | C ⁹ |
| C.10.c.2 | X ² | C ⁹ |
| C.10.c.3 | X | |
| C.10.c.4 | X | |
| C.10.c.5 | X ⁹ | C ⁹ |
| C.10.c.6 | | |
| C.11.a | X | |

| | | |
|--------|--|--|
| C.11.b | | |
| C.11.c | | |
| C.11.d | | |
| C.12 | | |
| C.13 | | |
| C.14 | | |

X Mandatory information.

O Optional information.

C This information need only be furnished when it has been used as a basis to effect coordination with another administration.

² Information mandatory for coordination under No. ADD S9.7A.

NOTE – Additional characteristics to be provided may include A.4.c, A.1.e.1, A.1.e.2, C.4, B.5 and C.5.b. As a result of decisions that may be made at WRC-2000, these additional characteristics may replace C.10.a, C.10.b, C.10.c.1, C.10.c.2 and C.10.c.5 in the notification or coordination of an earth station column.

Reasons: This is consequential to ADD S9.7A and ADD S9.7B. Administrations will need to submit specific earth station information for earth stations associated with geostationary-satellite networks in the fixed-satellite service meeting the conditions in the proposed addition to Appendix S5. Since there is currently no requirement to give the specific locations of earth stations, in addition to ADD S9.7A.2 and ADD S9.7B.2, a resolution for the transition period may also be needed to have typical earth stations associated with GSO FSS networks, already in coordination or notified, that meet the criteria to be brought in as specific earth stations. In this resolution, there will have to be some guidance on date priorities. The modifications under the column for *Notification or coordination of a GSO network (including Appendix S30B)* would apply to earth stations associated with GSO FSS networks already in coordination or notified. The modifications in the column for *Notification or coordination of an earth station* would apply to earth stations communicated to the Bureau after the date established by WRC-2000 under ADD S9.7A.1 and ADD S9.7B.1. Additional guidance will need to be added to the *Instructions for Filling Out the Form of Notice ApS4/II and ApS4/III Relating to Space Radiocommunications Stations* distributed by CR/65 or in a similar instruction.

../1.13/88 MOD (to
RR App. S4)

D – Overall link characteristics

(The modifications in either column two or column three need to be incorporated into the full table.)

| Items in Appendix | Notification or coordination of a geostationary satellite network (including Appendix S30B) | Notification or coordination of an earth station |
|-------------------|---|--|
| D.1 | X | |
| D.2.a | X ⁹ | C ⁹ |
| D.2.b | X | |

X Mandatory information.

O Optional information.

C This information need only be furnished when it has been used as a basis to effect coordination with another administration.

⁹ Information mandatory for coordination under No. ADD S9.7A

Reasons: This is consequential to ADD S9.7A and ADD S9.7B and will be required when simple frequency-changing transponders are used on the space station.

../1.13/89
ADD

APPENDIX S5
TABLE S5-1 (continued)

| Reference of Article S9 | Case | Frequency bands (and Region) of the service for which coordination is sought | Threshold/condition | Calculation method | Remarks |
|--|---|--|--|--|--|
| No. S9.7A GSO earth station/ non-GSO system | A specific earth station in a geostationary-satellite network in the fixed-satellite service in respect of a non-geostationary-satellite system in the fixed-satellite service. | The following frequency bands: 10.7-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth) | Conditions: i) the frequency bands overlap; and ii) the satellite network using the geostationary-satellite orbit has specific receive earth stations and meets all of the following conditions: a) Earth station antenna maximum isotropic gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz; b) G/T of 44 dB/K or higher; c) space station emission bandwidth of 250 MHz or higher for the frequency bands 10.7-12.75 GHz or 800 MHz or higher for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz; and iii) the EPFD _{down} from the satellite system using the non-geostationary orbit exceeds: | i) compare frequency bands; ii) use the maximum antenna gain (G) of the specific receive earth station (Appendix S4 C.10 c) 2)), the lowest equivalent satellite link noise temperature (T) (Appendix S4 C.10 c) 5)), and the space station emission bandwidth (Appendix S4 C.7 a)) in the geostationary-satellite network as given in Appendix S4 data; and iii) use the EPFD _{down} radiated by the non-GSO FSS system into the earth station employing the very large antenna when this antenna is pointed towards the wanted GSO satellite. | The threshold/condition for coordination do not apply to typical receive earth stations operating in satellite networks using the geostationary-satellite orbit. |

| | | | | | |
|---|---|--|--|--|--|
| | | | <p>a) either $-174.5 \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$ for any percentage of time or $[x] \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$ for $[y]\%$ of the time in the frequency band 10.7-12.75 GHz;</p> <p>b) either $-151 \text{ dB(W/(m}^2 \cdot \text{Hz))}$ for any percentage of time or $[x'] \text{ dB(W/(m}^2 \cdot \text{Hz))}$ for $[y']\%$ of the time in the frequency bands 17.8-18.6 GHz or 19.7-20.2 GHz.</p> | | |
| No. S9.7B non-GSO system/ GSO earth station/ | A non-geostationary-satellite system in the fixed-satellite service in respect of a specific earth station in a geostationary-satellite network in the fixed-satellite service. | The following frequency bands: 10.7-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth) | <p>Conditions:</p> <p>i) the frequency bands overlap; and</p> <p>ii) the satellite network using the geostationary-satellite orbit has specific receive earth stations and meets all of the following conditions:</p> <p>a) Earth station antenna maximum isotropic gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz;</p> <p>b) G/T of 44 dB/K or higher;</p> | <p>i) compare frequency bands;</p> <p>ii) use the maximum antenna gain (G) of the specific receive earth station (Appendix S4 C.10 c) 2)), the lowest equivalent satellite link noise temperature (T) (Appendix S4 C.10 c) 5)), and the space station emission bandwidth (Appendix S4 C.7 a)) in the geostationary-satellite network as given in Appendix S4 data; and</p> | The threshold/condition for coordination do not apply to typical receive earth stations operating in satellite networks using the geostationary-satellite orbit. |

| | | | | | |
|--|--|--|---|---|--|
| | | | <p>c) space station emission bandwidth of 250 MHz or higher for the frequency bands 10.7-12.75 GHz or 800 MHz or higher for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz: and</p> <p>iii) the EPFD_{down} from the satellite system using the non-geostationary orbit exceeds:</p> <p>a) either -174.5 dB(W/(m²•40 kHz)) for any percentage of time or [x] dB(W/(m²•40 kHz)) for [y]% of the time in the frequency band 10.7-12.75 GHz</p> <p>b) either -151 dB(W/(m²•MHz)) for any percentage of time or [x'] dB(W/(m²•MHz)) for [y']% of the time in the frequency bands 17.8-18.6 GHz or 19.7-20.2 GHz.</p> | <p>iii) use the EPFD_{down} radiated by the non-GSO FSS system into the earth station employing the very large antenna when this antenna is pointed towards the wanted GSO satellite.</p> | |
|--|--|--|---|---|--|

Reasons: This is consequential to ADD **S9.7A** and **S9.7B**.

Resolution 131 (WRC-97): Power Flux-Density limits applicable to non-GSO FSS systems for protection of terrestrial services in the bands 10.7 – 12.75 GHz and 17.7 – 19.3 GHz;

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, United States

Background Information: WRC-97 provisionally adopted pfd limits to be applied to non-GSO FSS systems operating in these bands. In the 10.7 – 12.75 GHz band, WRC-97 applied the existing limits to both GSO and non-GSO systems, subject to further study by the ITU-R under Resolution **131** (WRC-97). In the 17.7 – 19.3 GHz, WRC-97 adopted more stringent pfd limits for non-GSO FSS systems with more than 100 satellites.

Many studies were performed in WP4-9S and by the JTG4-9-11 to determine the appropriate pfd limits to be applied to non-GSO FSS systems in the aforementioned bands. The intent was to find suitable pfd limits that would ensure protection of the fixed service without unduly constraining the development of either service.

At the most recent meeting of the JTG4-9-11, the experts present agreed to limits for both frequency bands.

In the 10.7 – 12.75 GHz range, the JTG concluded that the current limits in Article **S21** are sufficient to protect the FS on the basis of the assumptions used in the studies. The JTG also recommended the use of a 1-MHz reference bandwidth for non-GSO system. The conclusions of the JTG4-9-11 are summarized below.

The current RR Article **S21** per satellite pfd limits, as defined below and as discussed more fully in draft new Rec. ITU-T SF.[Doc. 4-9S/AI](Submitted to RA-2000 for approval), are adequate for the protection of the FS in the 10.7-12.75 GHz band from aggregate interference from three assumed non-homogeneous, non-GSO FSS systems. Moreover, the contribution of GSO interference to the sharing has been shown as not being significant. Studies support and validate this conclusion. These results would remain valid if the number of non-GSO FSS systems were in the range 3 to 5.

- in the 10.7-11.7 GHz band :

| | |
|-------------------------|---|
| -126 | dB(W/m ²) per 1 MHz for $0^\circ \leq \delta < 5^\circ$ |
| $-126 + (\delta - 5)/2$ | dB(W/m ²) per 1 MHz for $5^\circ \leq \delta < 25^\circ$ |
| -116 | dB(W/m ²) per 1 MHz for $25^\circ \leq \delta < 90^\circ$ |

where δ is the angle of arrival above the horizontal plane.

- in the 11.7-12.75 GHz band :

| | |
|-------------------------|---|
| -124 | dB(W/m ²) per 1 MHz for $0^\circ \leq \delta < 5^\circ$ |
| $-124 + (\delta - 5)/2$ | dB(W/m ²) per 1 MHz for $5^\circ \leq \delta < 25^\circ$ |
| -114 | dB(W/m ²) per 1 MHz for $25^\circ \leq \delta < 90^\circ$ |

where δ is the angle of arrival above the horizontal plane.

In the 17.7 – 19.3 GHz range, the conclusion of the JTG was that a tightening of the original Article S21 pfd limits for non-GSO FSS with large constellations (over 50 satellites) would ensure protection of the fixed service while not unduly constraining the development of non-GSO FSS systems. The JTG conclusion were:

The following per satellite pfd limits (also described in draft new Rec. ITU-R SF.[Doc. 4-9S/TEMP/94]) (Submitted to RA-2000 for approval) are adequate for the protection of the FS in the 17.7 – 19.3 GHz band from aggregate interference from three assumed non-homogeneous non-GSO FSS systems. Moreover, the contribution of GSO interference to the sharing has been shown as not being significant. Studies support and validate this conclusion. These results would remain valid if the number of non-GSO FSS systems were in the range 3 to 5.

| | | |
|--|-------------------------------|---------------------------------------|
| -115 - X | dB(W/m ²) per MHz | for $0^\circ \leq \delta < 5^\circ$ |
| $-115 - X + ((10 + X)/20)(\delta - 5)$ | dB(W/m ²) per MHz | for $5^\circ \leq \delta < 25^\circ$ |
| -105 | dB(W/m ²) per MHz | for $25^\circ \leq \delta < 90^\circ$ |

where δ is the angle of arrival above the horizontal plane and X is defined as a function of the number of satellites in the non-GSO FSS constellation, N, as follows:

| | | |
|------------------------|-----------------------------|------|
| –for $N \leq 50$ | $X = 0$ | (dB) |
| –for $50 < N \leq 288$ | $X = \frac{5}{119}(N - 50)$ | (dB) |
| –for $N > 288$ | $X = \frac{1}{69}(N + 402)$ | (dB) |

The scaling function, X, was developed on the basis of non-GSO FSS constellations with 96, 288 and 840 satellites. Further simulations with different non-GSO FSS constellations comprising a wide range in the number of satellites (63, 126, 189, 252, and 504 satellites) and using the conservative pfd mask simulation method have confirmed the adequacy of this scaling function.

Further studies by some CITELE Administrations have shown that the interference levels obtained using the simple pfd mask methodologies used in the ITU-R studies are higher than those obtained using a more realistic modelling of the pfd entries. CITELE Administrations support the above pfd limits while noting that because of the operational characteristics of the non-GSO networks, interference margins will be present.

CITELE Objective: CITELE's objective is to ensure that the pfd limits in the bands 10.7 – 12.75 GHz and 17.8 – 19.3 GHz will provide adequate protection of the terrestrial services while not unduly constraining the design of non-GSO FSS networks. Since the studies conducted in ITU-R indicate that both objectives have been achieved with the masks proposed by the JTG 4-9-11, these limits should be adopted in Article S21 of the Radio Regulations.

Proposal(s):

1. It is proposed to retain the current **S21** PFD limits in the 10.7-12.75 GHz range, but scaling to a 1-MHz reference bandwidth for non-GSO systems and remove references to further studies.
2. It is proposed to adopt the compromise **S21** PFD limits in the 17.7-19.3 GHz band agreed to by the JTG4-9-11 and remove references to further studies.
3. As a consequence, it is proposed to delete Resolution **131** (WRC-97)
4. Changes in the frequency band column referring to S5.494 and S5.496 is required because the FS is allocated in all countries of Region 3.

../1.13.1/90

MOD

TABLE **S21-4** (CONTINUED)

Note: Only the portions of the table that were change were reproduced.

| Frequency band | Service* | Limit in dB(W/m ²) for angle of arrival (d) above the horizontal plane | | | Reference bandwidth |
|---|--|--|---|---|-----------------------------|
| | | 0°-5° | 5°-25° | 25°-90° | |
| 10.7-11.7 GHz | Fixed-satellite (space-to-Earth), <u>geostationary-satellite orbit</u> | -150 ¹⁴ | -150 + 0.5(δ - 5) ¹⁴ | -140 ¹⁴ | 4 kHz |
| <u>10.7 – 11.7 GHz</u> | <u>Fixed-satellite (space-to-Earth), non-geostationary-satellite orbit</u> | <u>-126</u> | <u>-126 + 0.5(δ - 5)</u> | <u>-116</u> | <u>1MHz</u> |
| 11.7-12.5 GHz (Region 1) <u>12.5 – 12.75 GHz (Region 1 countries listed in Nos. S5.494 and S5.496)</u> 11.7-12.27 GHz (Region 2) 11.7-12.275 GHz (Region 3) 12.2-12.7 GHz (Region 2) | Fixed-satellite (space-to-Earth), non-geostationary-satellite orbit | -148¹⁵ <u>-124</u> | -148 + 0.5(δ - 5)¹⁵ <u>-124 + 0.5(δ - 5)</u> | -138¹⁵ <u>-114</u> | <u>4 kHz</u> <u>1MHz</u> |
| 12.2-12.575 GHz⁷ (Region 3) 12.5-12.75 GHz ⁷ (Region 1 and Region 3 countries listed in Nos. S5.494 and S5.496) | Fixed-satellite (space-to-Earth), <u>geostationary-satellite orbit</u> | -148 ¹⁴ | -148 + 0.5(δ - 5) ¹⁴ | -138 ¹⁴ | 4 kHz |

| | | | | | |
|-------------------------------|--|---|--|--|-------|
| 17.7-19.3 GHz ^{7, 8} | Fixed-satellite (space-to-Earth) Meteorological- satellite (space-to- Earth) | -115 ^{aa} or -125 <u>-115 - X</u> ¹² | -115 + 0.5(δ - 5) ^{aa} or <u>-125 + (δ - 5)</u> <u>-115 - X + ((10 +</u> <u>X)/20) (δ - 5)</u> ¹² | -105 ^{aa} or -105 ¹² | 1 MHz |
|-------------------------------|--|---|--|--|-------|

../1.13.1/91

ADD

**** S21.16.6bis.** These limits apply to emissions of a space station on a meteorological-satellite and on a geostationary FSS satellite. These limits also apply to emissions of a space station on a non-geostationary FSS satellite in the band 18.8-19.3 GHz for which complete coordination or notification information has been received by the Radiocommunication Bureau by 17 November 1995, or are in operation by that date (WRC-00).

Reason: the above regulatory text (as contained in the CPM Report) reflects the date-specific provisions currently in Resolution 131.

../1.13.1/92

MOD

¹² **S21.16.6** ~~These values shall apply provisionally only to emissions of space stations on non-geostationary satellites in networks operating with a large number of satellites, that is systems operating with more than 100 satellites (see Resolution 131 (WRC-97)). (WRC-97)~~ The function X is defined as a function of the number, N, of satellites in the non-GSO FSS constellation as follows:

$$\begin{aligned}
 & \text{— for } N \leq 50 & X = 0 & \text{(dB)} \\
 & \text{— for } 50 < N \leq 288 & X = \frac{5}{119} (N - 50) & \text{(dB)} \\
 & \text{— for } N > 288 & X = \frac{1}{69} (N + 402) & \text{(dB)}
 \end{aligned}$$

In the band 18.8-19.3 GHz, these limits apply to emissions of a space station on a non-geostationary FSS satellite for which complete coordination or notification information, as appropriate, has been received by the Radiocommunication Bureau after 17 November 1995, and which were not operational by that date. (WRC-00)

Reason: The above regulatory text (as contained in the CPM Report) maintains the original limits for non-GSO FSS systems in the band 18.8-19.3 GHz that were notified or operational prior to the end of WRC-95 per the decisions in Resolution 131 (WRC-97). In the band 17.7-18.8 GHz, the new limits would apply to all non-GSO systems irrespective of the date of receipt of information or date of bringing into operation

../1.13.1/93

SUP

¹⁴ **S21.16.8** ~~Although these limits apply to both geostationary and non-geostationary satellites in the fixed-satellite service, values for non-geostationary satellite systems require further study (see Resolution 131 (WRC-97)). (WRC-97)~~

../1.13.1/94

SUP

¹⁵ **S21.16.9** These values require further study (see Resolution **131**
~~(WRC-97)~~). ~~(WRC-97)~~

../1.13.1/95

SUP

RESOLUTION 131 (WRC-97)

**~~Power flux density limits applicable to non-geostationary fixed-satellite
service systems for protection of terrestrial services in the
bands 10.7-12.75 GHz and 17.7-19.3 GHz~~**

Reasons : Replaces the provisional pfd limits in Table **S21-4** with the values that, as a result of extensive ITU-R studies, were agreed by WP 4-9S and JTG 4-9-11. **ADD^{aa}**

S21.16.6bis, and a corresponding change in **MOD¹² S21.16.6**, specify the dates of application of the pfd limits in conformance with the dates established in **RES131**.

Footnotes **S21.16.8**, **S21.16.9**, and **RES131** are no longer required.

WRC-2000 Agenda Item 1.13.2

to consider the inclusion in other frequency bands of similar limits in Articles S21 and S22, or other regulatory approaches to be applied in relation to sharing situations;

Proposals submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Colombia], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Ecuador, United States

Proposal(s):

../1.13.2/96

There have been no technical studies carried out in frequency bands other than those considered under Agenda Item 1.13.1. Consequently, there should not be any limits adopted in Article **S22** for frequency bands other than those identified in Resolutions **130** (WRC-97) and **538** (WRC-97) per Agenda Item 1.13.1.

WRC-2000 Agenda Item 1.14

To review the results of the studies on the feasibility of implementing non-GSO MSS feeder links in the 15.43-15.63 GHz in accordance with Resolution 123 (WRC-97).

Background Information: Studies conducted subject to Resolution **123 (WRC-97)** dealt with two aspects

1. Need for the allocation to non-GSO MSS feeder links in the band 15.43-15.63 GHz (space-to-Earth);
2. feasibility of implementing non-GSO MSS feeder links in the band 15.43-15.63 GHz (space-to-Earth) regarding protection of RAS, EESS (passive) and SRS (passive) operating in the band 15.35-15.4 GHz.

The ITU-R studies concluded that the space-to-Earth operation of non-GSO MSS feeder links in parts of the 15.43-15.63 band is significantly difficult and sometimes impossible, due to technical limitations that would have to be imposed on the feeder links.

The ITU-R studies complied with the Res. **123 (WRC-97)** provisions completely and hence covered all issues related to Agenda item 1.14. Taking into account that Res. **123 (WRC-97)** has attained its objectives and aims, it would be appropriate to suppress it.

The results of the studies, as reported in the CPM report, showed that it should be feasible to implement the existing non-GSO MSS feeder downlinks in the band 15.43-15.63 GHz taking into account the protection requirements for RAS and other passive services in this band. Providing that the existing non-GSO MSS feeder downlinks systems planning to use this band can provide the required protection to the passive services, the ITU-R studies did not identify any additional technical or operational disadvantages with respect to the existing systems.

The CPM report also concludes that, for future non-GSO MSS systems using the space-to-Earth allocation at 15.43-15.63 GHz substantial mitigation techniques would be required to adequately protect the RAS from harmful interference.

The technical studies also concluded that, because of high levels of suppression of out-of-band emissions required, use of the band 15.43-15.63 GHz for space-to-Earth feeder links should not extend beyond non-GSO MSS satellite networks for which advanced publication information has been received by the Bureau prior to WRC-2000.

Common CITEL proposals were developed to reflect this point of views.

Proposals submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, Mexico, United States

Remove the 15.43-15.63 GHz space-to-Earth allocation from the Tables of Article RR S5

| | | GHz | | |
|----------------------------------|----------------|---|----------|----------|
| ../1.14/97 IAP/1.14/50 MOD | | Allocation to services | | |
| | | Region 1 | Region 2 | Region 3 |
| | 15.43 – 15. 63 | FIXED SATELLITE (space-to-Earth) (Earth-to-space) MOD S5.511A AERONAUTICAL RADIONAVIGATION S5.511C | | |

../1.14/98
IAP/1.14/51

Suppress Resolution 123

~~RESOLUTION 123 (WRC-97)~~

~~Feasibility of implementing feeder links of non-geostationary satellite networks in the mobile-satellite service in the band 15.43 – 15.63 GHz (space-to-earth) while taking into account the protection of the radio astronomy service, the earth exploration-satellite (passive) service and the space research (passive) service in the band 15.35 – 15.4 GHz~~

../1.14/99
IAP/1.14/52

Modify **S5.511A** as follows:

MOD

S5.511A Use of the band 15.43-15.63 GHz by the fixed satellite service ~~(space-to-Earth)~~ (see Resolution ~~123 (WRC-97)~~ and Earth-to-space) is limited to feeder links of non-geostationary systems in the mobile-satellite service, subject to coordination under No. **S911A**.

In the space-to-Earth direction the use of this band is limited to feeder links of non-GSO MSS systems for which advanced publication information has been received prior to WRC-2000 the minimum earth station elevation angle above and gain towards the local horizontal plane and the minimum coordination distances to protect an earth station from harmful interference shall be in accordance with Recommendation ITU-R S.1341. Also in the space-to-Earth direction, harmful interference shall not be caused to stations of the radio astronomy service using the band 15.35-15.4 GHz. The threshold levels of interference and associated power flux-density limits, which are detrimental to the radio astronomy service, are given in Recommendation

ITU-R RA.769-1 for 98% of the time. Special measures will need to be employed to protect the radio astronomy service in the band 15.35-15.4 GHz. ~~(WRC-97)~~

WRC-2000 Agenda Item 1.15.1

to consider new allocations to the radionavigation-satellite service in the range from 1 GHz to 6 GHz required to support developments

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador] [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Colombia, United States

Background Information: Additional Radionavigation-Satellite Service (RNSS) signals will greatly enhance the accuracy, reliability and robustness of the civil Global Positioning System (GPS) by enabling more effective corrections to be made for the time delay effects of the ionosphere on the signals from space. The International Civil Aviation Organization (ICAO) has stated the requirement for an additional civil signal on GPS to support Global Navigation Satellite System (GNSS) requirements and for space-based augmentation systems. A requirement for aeronautical users is having the protected signal operate within radio spectrum allocated to the Aeronautical Radionavigation Service (ARNS), which would also include the possibility of terrestrial augmentation systems.

The United States has identified a third signal at 1 176.45 MHz to support GNSS developments. The third signal is proposed to be an international civil aviation safety-of-life service signal with a required bandwidth 24 MHz. Technical studies show compatibility between existing operational ARNS systems and the proposed new signal at 1 176.45 MHz. The power levels and signal structure will allow the operation of a relatively large number of co-frequency satellite and terrestrial stations to be in view of an RNSS receiver.

The Member States of CITELE also note that the report of the Preparatory Meeting of the Conference, CPM-99, identifies certain additional bands, which are options that may be taken into account to support the development of other GNSS systems.

Proposal(s):

Section IV – Table of Frequency Allocations

MHz

960-1 215

| Allocation to services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 960-1 215 | AERONAUTICAL RADIONAVIGATION MOD S5.328 | |

**../1.15.1/100
MOD**

S5.328 The band 960 - 1 215 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based and satellite-borne facilities. In the 1 164 - 1 188 MHz portion of this band, the radionavigation-satellite service (space-to-Earth) is also allocated worldwide on a primary basis. In this band stations of the radionavigation-satellite services, but not in the aeronautical radionavigation-satellite service, shall not cause harmful interference to, or claim protection from, stations of the aeronautical radionavigation and aeronautical radionavigation-satellite services.

Reasons: Additional Radionavigation-Satellite Service (RNSS) signals will greatly enhance the accuracy, reliability and robustness of the civil Global Navigation Satellite System (GNSS) by enabling more effective corrections to be made for the time delay effects of the ionosphere on the signals from space.

WRC-2000 Agenda Item 1.15.2

to consider the addition of the space-to-space direction to the radionavigation-satellite service allocations in the bands 1 215 - 1 260 and 1 559 - 1 610 MHz

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Colombia, Mexico, United States

Background Information: Radionavigation-Satellite Service (RNSS) systems such as the Global Positioning System and Global Navigation Satellite System are primarily being used in the space-to-Earth direction to provide service to terrestrial users. These systems are, however, also increasingly being used in the space-to-space direction by spaceborne users for such applications as spacecraft three-dimensional positioning and velocity determination; three-axis attitude control; precise time synchronization; precision orbit determination, and atmospheric science. The use of RNSS signals is presently protected only through a space-to-Earth allocation in the 1 215 - 1 260 and 1 559 - 1 610 MHz bands. Recognizing current and future operational usage of spaceborne RNSS receivers for scientific and commercial applications, it is important to add the space-to-space direction to the existing RNSS allocations so that these uses can be taken into consideration when changes to the use of these bands are contemplated.

Interference studies have been conducted to assess the sensitivity of spaceborne RNSS receivers to interference from radiolocation, Earth exploration-satellite (active), space research (active), fixed, mobile and aeronautical radionavigation services in the 1 215 - 1 260 MHz band; from the aeronautical radionavigation and fixed services in the 1 559 - 1 610 MHz band; and also their sensitivity to intra-service interference between radionavigation satellite service systems in these two bands.

The ITU-R has concluded that the addition of a space-to-space direction to the 1 215 - 1 260 MHz and 1 559 - 1 610 MHz RNSS bands will not cause any additional interference to other services since it involves no change to the space-to-Earth transmissions.

Studies demonstrate that RNSS spaceborne receivers can operate satisfactorily in the presence of interference caused by systems in other services as well as other RNSS systems. Potential interference from services in adjacent bands was also examined.

Existing coordination procedures are adequate for space-to-space operations and no additional protection will be required.

Proposal(s):

../1.15.2/101

MOD

MHz
1 215 – 1 260

| Allocation to Services | | | | | |
|------------------------|--|--|--------|----------|----------------------|
| Region 1 | | Region 2 | | Region 3 | |
| 1 215-1 240 | | EARTH EXPLORATION-SATELLITE (active) | | | |
| | | RADIOLOCATION | | | |
| | | RADIONAVIGATION-SATELLITE (space-to-Earth) | | | |
| | | (space-to-space) | | | |
| | | SPACE RESEARCH (active) | | | |
| | | S5.329 | S5.330 | S5.331 | S5.332 |
| 1 240-1 260 | | EARTH EXPLORATION-SATELLITE (active) | | | |
| | | RADIOLOCATION | | | |
| | | RADIONAVIGATION-SATELLITE (space-to-Earth) | | | |
| | | (space-to-space) | | | |
| | | SPACE RESEARCH (active) | | | |
| | | Amateur | | | |
| | | S5.329 | S5.330 | S5.331 | S5.332 S5.334 S5.335 |

Reasons: Provide an allocation for space-to-space use for RNSS, which will ensure the protection of space-based RNSS receivers.

../1.15.2/102

MOD

MHz
1 559 – 1 610

| Allocation to Services | | |
|--|----------|----------|
| Region 1 | Region 2 | Region 3 |
| 1 559 – 1 610 | | |
| AERONAUTICAL RADIONAVIGATION | | |
| RADIONAVIGATION-SATELLITE (space-to-Earth) | | |
| <u>(space-to-space)</u> | | |
| S5.341 S5.355 S5.359 S5.363 | | |

Reasons: Provide an allocation for space-to-space use for RNSS, which will ensure the protection of space-based RNSS receivers.

WRC-2000 Agenda Item 1.16

to consider allocations of frequency bands above 71 GHz to the earth-exploration satellite (passive) and radio astronomy services, taking into account Resolution 723

Proposal to modify the allocations above 71 GHz

Submitted by the following Administrations:

[Antigua and Barbuda], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Colombia], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Argentina, Mexico, United States

Background Information: The following proposals modify many of the allocation tables above 71 GHz to accommodate the requirements of the radio astronomy and earth-exploration satellite (passive) services, while giving consideration to the needs of other services. The modifications to the allocation tables maintain the aggregate amount of spectrum allocated to the displaced services (including the fixed-satellite service), provide frequency blocks 5-9 GHz wide to accommodate future wideband multimedia systems while taking into account differences in atmospheric attenuation, and provide appropriate separation between services.

Resolutions XXX and YYY address the need for future study between co-allocated active services and between active and passive services at such a time when the technical characteristics of the active services become known. Also, CITELE may submit at a later date a corrigendum to this proposal addressing allocations to active services within the bands 71-86 GHz.

Proposal(s):

GHz
71 – 74

**../1.16/ 103
MOD**

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 71 – 74 | FIXED FIXED-SATELLITE (Earth-to-space) <u>(space-to-Earth)</u> MOBILE MOBILE-SATELLITE (Earth-to-space) <u>(space-to-Earth)</u> S5.149 – S5.556 | |

Reason: MSS and FSS uplinks and downlinks in 71-74 GHz and 81-84 GHz bands have been interchanged to avoid satellite downlinks in bands needed by RAS. Atmospheric absorption is only slightly higher in 71-74 GHz band than in 81-84 GHz band. The RAS footnotes **S5.149** and **S5.556** have been deleted in favor of allocations above 76 GHz. The reference to the 72.77-72.91 GHz band in footnotes **S5.149** and **S5.556** has been deleted.

GHz
74 – 76

**../1.16/ 104
MOD**

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 74 – 75.5 | <u>BROADCASTING-SATELLITE</u> FIXED FIXED-SATELLITE (Earth-to-space) <u>FIXED-SATELLITE (space-to-Earth)</u> MOBILE Space Research (space-to-Earth) <u>MOD S5.561</u> | |
| 75.5 – 76 | AMATEUR AMATEUR-SATELLITE <u>BROADCASTING-SATELLITE</u> <u>FIXED</u> <u>FIXED-SATELLITE (space-to-Earth)</u> <u>MOBILE</u> Space Research (space-to-Earth) <u>MOD S5.561</u> <u>ADD S5.EEE</u> | |

**../1.16/ 105
MOD**

Reason: BSS, which is currently allocated to the 84-86 GHz band, has been relocated to this band to protect RAS above 76 GHz. Atmospheric absorption is only slightly higher in 74-76 GHz band than in 84-86 GHz band. Amateur and Amateur-Satellite allocations have been shifted to 80.5-81 GHz. The new footnote **S5.EEE** protects existing Amateur and Amateur-Satellite operations in the 75.5-76 GHz band until the year 200[X]. The FSS (Earth-to-space) allocation has been moved to 84-86 GHz band. The proposed allocations in the 74-84 GHz range preserve a contiguous 10 GHz space research downlink (secondary), which is required for space VLBI purposes. The footnote **S5.561** has been modified to recognize the change in BSS allocation.

GHz
76 – 81

| Allocation to Services | | | |
|------------------------|-------------------------|---|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 106 MOD | <u>76 – 81</u> | <u>RADIO ASTRONOMY</u> RADIOLOCATION Amateur Amateur-Satellite Space Research (space-to-Earth) S5.560 MOD <u>S5.149</u> | |
| ../1.16/ 107 MOD | <u>77.5 – 78</u> | <u>AMATEUR</u> <u>AMATEUR SATELLITE</u> <u>RADIOLOCATION</u> Amateur Amateur-Satellite <u>Radio Astronomy</u> Space Research (space-to-Earth) S5.560 MOD <u>S5.149</u> | |
| ../1.16/ 108 MOD | <u>78 – 81</u> | <u>RADIO ASTRONOMY</u> RADIOLOCATION Amateur Amateur-Satellite Space Research (space-to-Earth) S5.560 MOD <u>S5.149</u> | |

Reason: The existing 76 - 81 GHz band has been divided into three sub-bands. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide in both the 76 - 77.5 GHz and 78 – 81 GHz bands. Radio astronomy is added as a secondary allocation in the 77.5 – 78 GHz band. Amateur and amateur-satellite services are shifted by 0.5 GHz, to accommodate BS, FSS and MSS downlinks at the lower portion of atmospheric window, and to avoid sharing with vehicular radars, which some Administrations have authorized to operate in the 76-77 GHz band. There is no change in sharing between services, except for introduction of RAS allocation in the upper and lower sub-bands. These bands have been added to those listed under **S5.149**. The footnote **S5.560** is deleted from the 76 - 77.5 and 77 - 78 GHz sub-bands, where it doesn't apply.

../1.16/ 109
MOD

GHz
81 – 84

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 81 – 84 | <p>FIXED</p> <p>FIXED-SATELLITE (space-to-Earth)</p> <p><u>FIXED-SATELLITE (Earth-to-space)</u></p> <p>MOBILE</p> <p>MOBILE-SATELLITE (space-to-Earth)</p> <p><u>MOBILE-SATELLITE (Earth-to-space)</u></p> <p><u>RADIO ASTRONOMY</u></p> <p>Space research (space-to-Earth)</p> <p><u>MOD S5.149 S5.DDD</u></p> | |

Reason: The directions of MSS and FSS downlinks have been reversed to allow radio astronomy observations. The uplinks are paired with the 71-74 GHz downlinks. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. The footnote **S5.DDD** has been added to maintain the current amount of secondary amateur and amateur-satellite spectrum. This band has been added to footnote **S5.149**.

../1.16/ 110
MOD

GHz
84 – 86

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 84 – 86 | <p>BROADCASTING</p> <p>BROADCASTING-SATELLITE</p> <p>FIXED</p> <p><u>FIXED-SATELLITE (Earth-to-space)</u></p> <p>MOBILE</p> <p><u>RADIO ASTRONOMY</u></p> <p><u>MOD S5.149 S5.561</u></p> | |

Reason: The Broadcasting Satellite allocation has been relocated to 74-76 GHz band. The direction of satellite downlinks has been reversed to allow radio astronomy observations. The uplink has been paired with 74-76 GHz downlink. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. This band has been added to footnote **S5.149**. The **S5.561** footnote is no longer relevant

to this band; appropriately modified it now applies to the 74-75.5 GHz and 75.5 - 76 GHz bands.

GHz

86 – 92

../1.16/111
NOC

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 86 – 92 | EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 | |

Reason: This band is of crucial importance to the RAS, SR (passive) and EES (passive) services; it is the window for the band around 118.75 GHz. No active services are acceptable in this band and no change in current allocations is feasible.

GHz

92 – 94

../1.16/ 112
MOD

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 92 – 94 | FIXED FIXED SATELLITE (Earth to space) MOBILE <u>RADIO ASTRONOMY</u> RADIOLOCATION MOD S5.149 -S5.556 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. Previously, radio astronomy interest was recognised via footnote **S5.556**. The FSS (Earth-to-space) allocation, no longer needed to balance 102-105 GHz allocation, has been relocated to 71-76 GHz band. This band has been added to those listed under **S5.149**. Footnote **S5.556** has been deleted from this band, as it is no longer necessary.

../1.16/ 113
MOD

GHz
94 – 94.1

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 94 – 94.1 | EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) <u>Radio Astronomy</u> S5.562 | |

Reason: The radio astronomy service is secondary to the active services. No change in sharing between services is proposed, except for introduction of the RAS allocation in this band.

../1.16/ 114
MOD

GHz
94.1 – 95

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 94.1 – 95 | FIXED FIXED SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY</u> RADIOLOCATION MOD S5.149 S5.556 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. No change in sharing between existing services, except for introduction of RAS allocation in band. The FSS (Earth-to-space) allocation, no longer needed to balance 102-105 GHz, has been relocated to 71-76 GHz band. The footnote **S5.556** is deleted, as it is not relevant to this band (should have been suppressed consequential to WRC-97 actions). This band has been added to those listed under **S5.149**.

../1.16/115
MOD

GHz
95 – 100

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 95 – 100 | <u>FIXED MOD S5.553</u> MOBILE MOD S5.553 MOBILE SATELLITE <u>RADIO ASTRONOMY</u> <u>RADIOLOCATION</u> RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation MOD S5.149 MOD S5.554 –S5.555 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. Radiolocation has been upgraded to primary, consequential to the addition of radio astronomy as a primary service. The mobile satellite service is deleted, as it cannot share with the Radiolocation service. This band has been added to those listed under **S5.149**. Footnote **S5.555**, which allocates the 97.88-98.08 GHz sub-band to the RAS on a primary basis has been deleted, and the band has been deleted from footnote **S5.555**. The footnote **S5.553** has been modified to include stations in the fixed service.

../1.16/ 116
MOD

GHz
100 – 102

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 100 – 102 | EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE <u>RADIO ASTRONOMY</u> SPACE RESEARCH (passive) MOD S5.149 S5.341 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. There is no change in sharing between services, except for introduction of RAS allocation in band. This band is used by EES (passive) for limb sounding of atmospheric constituents (NO line at 100.49 GHz). This band added to those listed under **S5.149**.

../1.16/ 117
MOD

GHz
102 – 105

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 102 – 105 | FIXED FIXED SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>MOD S5.149 S5.341</u> | |

Reason: The FSS allocation has been moved to 74-76 GHz band, to eliminate downlinks in the middle of the atmospheric window needed for radio astronomy observations. Atmospheric absorption in these two windows is similar. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. This band has been added to those listed under **S5.149**.

../1.16/ 118
MOD

GHz
105 – 109.5

| Allocation to Services | | |
|----------------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 105 – 116109.5 | EARTH EXPLORATION SATELLITE (passive) <u>FIXED</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) <u>5.CCC</u> <u>MOD S5.149 S5.340 S5.341</u> | |

Reason: The 105-116 GHz range has been divided into 4 sub-bands to make additional spectrum available for other services and to adjust other passive allocations to areas of the spectrum that are more appropriate to meet scientific needs. Passive sensors have no known use for, and do not need the band 105-109.5 GHz, so they have been deleted. Fixed and mobile services have been added, relocated from 116 - 122.5 GHz band, where deletion of these services is needed to protect essential passive sensor operations. Since this band is no longer passive in nature, footnote **S5.340** should be deleted. This band is added to those included under S5.149, to reflect the need to protect radio astronomy in a band that is no longer passive. Footnote **S5.CCC** is added to limit Space Research (passive) allocation to space-based radio astronomy in this band.

../1.16/ 119
MOD

| GHz | | |
|------------------------|--|----------|
| 109.5 – 111.8 GHz | | |
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>109.5 – 111.8</u> | EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341 | |

Reason: It is essential to maintain this passive band. The **MOD** refers to the band limits only; no change (**NOC**) is proposed to the allocations within this sub-band. This band contains an ozone line at 110.8 GHz, which is used for microwave limb sounding. The entire band is of vital importance to radio astronomy for observations of the CO lines at 109.8 and 110.2 GHz, and continuum observations.

../1.16/ 120
MOD

| GHz | | |
|------------------------|--|----------|
| 111.8 – 114.25 GHz | | |
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>111.8 – 114.25</u> | EARTH EXPLORATION-SATELLITE (passive) <u>FIXED</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) <u>S5.CCC</u> MOD S5.149 S5.340 S5.341 | |

Reason: Passive sensors do not need the band 111.8-114.25 GHz and have been deleted. Fixed and mobile services are added to this band, they were relocated from the 116 - 122.5 GHz band where deletion of these services is needed to protect essential passive sensor operations. This band is added to those included under **S5.149** to reflect the need to protect radio astronomy in a band that is no longer passive. The addition of the new footnote **S5.CCC** limits the Space Research (passive) allocation to space-based radio astronomy in this band.

../1.16/ 121
MOD

| GHz | | |
|------------------------|--|----------|
| 114.25 -- 116 GHz | | |
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| 114.25 – 116 | EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341 | |

Reason: It is essential to maintain this passive band. The **MOD** refers to the band limits only; no change (**NOC**) is proposed to the allocations within this sub-band. The band 114.25-116 GHz is of vital importance to radio astronomy for observations of the 115.3 GHz CO line and is the first portion of the 114.25-122.25 GHz oxygen absorption band which is required for remote sensing, with a peak at 118.75 GHz.

GHz
116 – 122.25

| Allocation to Services | | | |
|------------------------|---|---|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 122 MOD | 116 – 119.98 | EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>ADD S5.XXX</u> MOBILE – S5.558 SPACE RESEARCH (passive) S5.138 S5.341 | |
| ../1.16/ 123 MOD | 119.98 – 120.02 | EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>ADD S5.XXX</u> MOBILE – S5.558 SPACE RESEARCH (passive) Amateur S5.341 | |
| ../1.16/ 124 MOD | 120.02 – 126<u>122.25</u> | EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>ADD S5.XXX</u> MOBILE – S5.558 SPACE RESEARCH (passive) S5.138 S5.341 | |

Reason: This band is of crucial importance for passive sensing, as it is comprised the majority of the necessary 114.25-122.25 GHz band, the oxygen absorption band, with its peak at 118.75 GHz. The fixed and mobile services have been moved down to 105 - 109.5 GHz and 111.8-114.25 GHz, as sharing with passive sensors would severely restrict these services in this portion of the spectrum. The inter-satellite service needs to be limited by footnote **S5.XXX** to links between GSO satellites only, with pfd limits as specified in sharing studies in order to share the band 116-122.25 GHz with passive sensors. The secondary allocation to amateur services in the band 119.98-120.02 GHz is also moved to 122.5-123 GHz band to avoid interference to passive sensors.

../1.16/ 125
MOD

| GHz | | |
|------------------------|---|----------|
| 122.25 – 123 | | |
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>122.25 – 123</u> | EARTH EXPLORATION SATELLITE (passive) FIXED INTER-SATELLITE MOBILE MOD S5.558 SPACE RESEARCH (passive) <u>Amateur</u> S5.138 S5.341 | |

Reason: The passive sensor allocations have been deleted from this band, as they are not needed for remote sensing applications. A secondary amateur service allocation has been added to compensate for the deletion of their allocation in the 119.98-120.02 GHz band.

../1.16/ 126
MOD

| GHz | | |
|------------------------|---|----------|
| 123 – 126 | | |
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>123 - 126</u> | EARTH EXPLORATION SATELLITE (passive) FIXED <u>FIXED-SATELLITE (space-to-Earth)</u> INTER-SATELLITE MOBILE MOD S5.558 <u>MOBILE-SATELLITE</u> <u>RADIONAVIGATION</u> <u>RADIONAVIGATION-SATELLITE</u> SPACE RESEARCH (passive) <u>Radio Astronomy</u> S5.138 S5.341 | |

Reason: This band is not required for passive sensor operations and those allocations have been deleted. Satellite downlinks from 141-153 GHz band have been moved to the 123-130 GHz band to avoid interference to the radio astronomy service. The radio astronomy service is added on a secondary basis, for possible use in wide-band continuum observations. Sharing conditions between the ISS and the FSS, MSS, RNS and RNSS services need to be developed, but no imminent use of the band by these services is contemplated. The MSS directional indicator has been left undefined. The footnotes

S5.138 and **S5.341** do not apply to this band due to changed band limit, and are consequentially deleted.

GHz

126 – 130

../1.16/ 127
MOD

| Allocation to Services | | |
|---------------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 126 – 134 130 | FIXED <u>FIXED SATELLITE (space-to-Earth)</u> INTER-SATELLITE MOBILE S5.558 <u>MOBILE SATELLITE</u> RADIOLOCATION S5.559 <u>RADIONAVIGATION</u> <u>RADIONAVIGATION-SATELLITE</u> <u>Radio Astronomy</u> MOD S5.554 | |

Reason: Satellite downlinks from 141-153 GHz band have been moved to the 123-130 GHz band to avoid interference to the radio astronomy service. The radio astronomy service is added on a secondary basis for spectral line and wide-band continuum observations. The fixed, mobile, inter-satellite and radiolocation allocations have been relocated to improve sharing situations. Sharing conditions between the FSS, MSS, RNS and RNSS services need to be developed, but no imminent use of the band by these services is contemplated. The MSS directional indicator has been left undefined. The footnote **S5.554** has been modified to include this band.

GHz

130 – 134

../1.16/ 128
MOD

| Allocation to Services | | |
|-------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| <u>130 – 134</u> | FIXED INTER-SATELLITE MOBILE MOD S5.558 <u>RADIO ASTRONOMY</u> RADIOLOCATION S5.559 <u>MOD S5.149</u> | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. Sharing conditions between the RAS and the ISS need to be developed. Footnote **S5.558** is modified to reflect new mobile service band limit. Radiolocation service has been relocated, to improve sharing conditions.

../1.16/ 129
MOD

GHz
134 – 136

| Allocation to Services | | |
|---------------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 134 – 142 136 | <u>AMATEUR</u> <u>AMATEUR-SATELLITE</u> MOBILE S5.553 MOBILE SATELLITE RADIONAVIGATION RADIONAVIGATION SATELLITE <u>Radio Astronomy</u> Radiolocation S5.149 S5.340 S5.554 S5.555 | |

Reason: The amateur and amateur-satellite services are moved here from 142-144 GHz band to avoid interference to radio astronomy at higher frequencies. Radio astronomy is added as secondary service. All footnotes are deleted, as they no longer apply to this band.

GHz
136 – 141

../1.16/ 130
MOD

| Allocation to Services | | |
|-------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| <u>136 – 141</u> | MOBILE S5.553 MOBILE SATELLITE <u>RADIO ASTRONOMY</u> <u>RADIOLOCATION</u> RADIONAVIGATION RADIONAVIGATION SATELLITE <u>Amateur</u> <u>Amateur-Satellite</u> Radiolocation MOD S5.149 S5.340 S5.554 S5.555 | |

Reason: Services currently allocated to 144 -149 GHz band are moved to this band to facilitate realignment. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. This band added to those listed under **S5.149**. Since this band is no longer passive, it is removed from **S5.340**. The footnote **S5.554** no longer applies to this band and is deleted. Footnote **S5.555** no longer needed,

as the radio astronomy service is allocated on a primary basis in the entire 136-141 GHz band.

GHz
141 – 148.5

../1.16/ 131
MOD

| Allocation to Services | | |
|-------------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| <u>141 – 142</u> | <u>FIXED</u> MOBILE S5.553 MOBILE SATELLITE <u>RADIO ASTRONOMY</u> <u>RADIOLOCATION</u> RADIONAVIGATION RADIONAVIGATION SATELLITE Radiolocation MOD S5.149 S5.340 S5.554 S5.555 | |
| <u>142 – 144</u> | AMATEUR AMATEUR SATELLITE <u>FIXED</u> <u>MOBILE</u> <u>RADIO ASTRONOMY</u> <u>RADIOLOCATION</u> MOD S5.149 | |
| <u>144 – 149 148.5</u> | <u>FIXED</u> <u>MOBILE</u> <u>RADIO ASTRONOMY</u> RADIOLOCATION Amateur Amateur Satellite MOD S5.149 S5.555 | |

../1.16/ 132
MOD

../1.16/ 133
MOD

Reason: Allocations are transferred to the 141-148.5 GHz band from the 126-134 GHz band to allow for radio astronomy allocations in this band. The bandwidth has been reduced to 7.5 GHz to accommodate EES (passive) and SR (passive) requirements in the 148.5-151.5 GHz band. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. Since the 141-142 GHz sub-band is no longer passive, **S5.340** is deleted from that band and modified accordingly. All sub-bands are added to those listed under **S5.149**. Footnotes **S5.554** and **S5.555** no longer apply to any portion of this band and are deleted and modified accordingly.

GHz
148.5 – 151.5

| Allocation to Services | | | |
|-----------------------------|---------------------------|--|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 134 MOD | <u>148.5</u> – 149 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> <u>RADIO ASTRONOMY</u> RADIOLOCATION <u>SPACE RESEARCH (passive)</u> Amateur Amateur Satellite S5.149 MOD S5.340 S5.555 | |
| ../1.16/ 135 MOD | 149 – 150 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> MOD S5.340 | |
| ../1.16/ 136 MOD | 150 – 151 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> S5.149 MOD S5.340 S5.385 | |
| ../1.16/ 137 MOD | 151 – <u>151.5</u> | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> MOD S5.340 | |

Reason: The current passive allocation of 150-151 GHz has insufficient bandwidth for remote sensing observations and is not adequately protected from potential interference. The scientific requirement is for a 3 GHz band centered at 150 GHz for use in conjunction with water vapour observations around 183 GHz. Also, the 150.74 GHz nitrous oxide line

at required for microwave limb sounding applications. All active services are relocated from this band to meet these requirements. Since the 148.5-151.5 GHz band is now purely passive, it is added to those listed under **S5.340**. For the same reason, there is no need to include the band 150-151 GHz in **S5.149**, and it is deleted from this footnote. The footnotes **S5.385** (150-151 GHz band) and **S5.555** (148.5-149 GHz band) are no longer needed and are deleted from these bands.

GHz

151.5 – 155.5

../1.16/ 138
MOD

| Allocation to Services | | |
|-------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 151.5 – 156.55.5 | FIXED FIXED SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>RADIOLOCATION</u> <u>MOD S5.149</u> | |

Reason: The FSS downlink allocation is incompatible with radio astronomy requirements in this band and is relocated elsewhere. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. This band is added to those listed under footnote **S5.149**. The additional radiolocation allocation compensates for removal from the 126-134 GHz band.

GHz
155.5 – 158.5

| Allocation to Services | | | |
|------------------------|---|---|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 139 MOD | <u>155.5 – 156</u> <u>S5.AAA</u> | <u>EARTH EXPLORATION-SATELLITE (passive) ADD</u> FIXED <u>ADD S5.BBB</u> FIXED SATELLITE (space to Earth) MOBILE <u>ADD S5.BBB</u> <u>RADIO ASTRONOMY</u> <u>SPACE RESEACH (passive) ADD S5.CCC</u> <u>MOD S5.149</u> | |
| ../1.16/ 140 MOD | <u>156 – 158</u> <u>S5.AAA</u> | <u>EARTH EXPLORATION-SATELLITE (passive) ADD</u> FIXED <u>ADD S5.BBB</u> FIXED SATELLITE (space to Earth) MOBILE <u>ADD S5.BBB</u> <u>RADIO ASTRONOMY</u> <u>SPACE RESEACH (passive) ADD S5.CCC</u> <u>MOD S5.149</u> | |
| ../1.16/ 141 MOD | <u>158 – 164</u> <u>58.5</u> <u>S5.AAA</u> | <u>EARTH EXPLORATION-SATELLITE (passive) ADD</u> FIXED <u>ADD S5.BBB</u> FIXED SATELLITE (space to Earth) MOBILE <u>ADD S5.BBB</u> <u>RADIO ASTRONOMY</u> <u>SPACE RESEACH (passive) ADD S5.CCC</u> <u>MOD S5.149</u> | |

Reason: The scientific requirement is for a 3 GHz band centered at 157 GHz for use in conjunction with water vapour observations around 183 GHz. This allocation is only required until 2018 since current planned and operational instruments are already in this band. By 2018, all of these applications will have transitioned to the 148.5-151.5 GHz band. The FSS downlink allocation is incompatible with radio astronomy requirements and is relocated. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations worldwide. These sub-bands are added to those listed under **S5.149**. EES operations in the band 155.5-158.5 GHz need to be protected until 1/1/2018. After this date the fixed and mobile services need to co-ordinate with radio astronomy sites only. The space research (passive) allocation is limited to space-based radio astronomy in this band.

../1.16/ 142
MOD

| GHz 158.5 – 164 | | |
|------------------------|---|----------|
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| 158.5 – 164 | FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>MOBILE-SATELLITE (space-to-Earth)</u> | |

Reason: Mobile-satellite allocation has been added to partially compensate for loss of 134-142 GHz band.

../1.16/ 143
MOD

| GHz 164 – 167 | | |
|------------------------|---|----------|
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| 164 – 1687 | EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) <u>MOD S5.340</u> | |

Reason: Passive sensors require only this 3 GHz band from the current 164-168 GHz passive allocation. It is essential to maintain the 164 - 167 GHz portion of the band passive. The **MOD** refers to the band limits and addition of the band to footnote **S5.340** only, no change (**NOC**) is proposed to the allocations within this sub-band. This band, along with the band 148.5-151.5 GHz will become the harmonised reference window for passive sensor observations of the 183.31 GHz water vapor line. The band is also used for microwave limb sounding of the 164.38 GHz ClO line. This passive band has been added to those listed under **S5.340**; the 164-168 GHz band had been omitted from **S5.340**.

GHz
167 – 174.8

| Allocation to Services | | | |
|-----------------------------|---|--|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 144 MOD | <u>167</u> – 168 | EARTH EXPLORATION SATELLITE (passive) <u>FIXED</u> <u>FIXED-SATELLITE (space-to-Earth)</u> <u>INTER-SATELLITE</u> <u>MOBILE MOD S5.558</u> RADIO ASTRONOMY SPACE RESEARCH (passive) | |
| | 168 – 170 | FIXED <u>FIXED-SATELLITE (space-to-Earth)</u> <u>INTER-SATELLITE</u> MOBILE MOD S5.558 | |
| | 170 – 174.5 | FIXED <u>FIXED-SATELLITE (space-to-Earth)</u> INTER-SATELLITE MOBILE MOD S5.558 S5.149 – S5.385 | |
| | 174.5 – 176.5<u>174.8</u> | EARTH EXPLORATION SATELLITE (passive) FIXED INTER-SATELLITE MOBILE MOD S5.558 SPACE RESEARCH (passive) S5.149 – S5.385 | |

Reason: Passive services do not need the 167-168 GHz band and this band is yielded to displaced active services. Fixed, mobile and inter-satellite services are added to the 167-174.8 GHz band as well as fixed-satellite downlinks to the 167-174.5 GHz band to compensate for deletions in other bands. Passive sensor allocations are deleted from the 174.5-174.8 GHz band to properly adjust the band edge for the 183.3 GHz remote sensing requirement. Footnotes **S5.149** and **S5.385** are deleted from these bands and are appropriately modified. Footnote **S5.558** is added next to mobile allocations in this band and the footnote is modified to include the 167-174.8 GHz band due to sharing with the inter-satellite service.

GHz
174.8 – 191.8

| Allocation to Services | | | |
|-----------------------------|----------------------------------|--|----------|
| | Region 1 | Region 2 | Region 3 |
| ../1.16/ 148 MOD | 174.58 – 176.5 | EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>ADD S5.YYY</u> —MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385 | |
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| ../1.16/ 149 MOD | 176.5 – 182 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED INTER-SATELLITE <u>ADD S5.YYY</u> —MOBILE S5.558 <u>SPACE RESEARCH (passive)</u> S5.149 S5.385 | |
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| ../1.16/ 150 MOD | 182 – 185 | EARTH EXPLORATION-SATELLITE (passive) RADIO-ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.563 | |
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| ../1.16/ 151 MOD | 185 – 190 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED INTER-SATELLITE <u>ADD S5.YYY</u> MOBILE S5.558 <u>SPACE RESEARCH (passive)</u> S5.149 S5.385 | |
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| ../1.16/ 152 MOD | 190 – 200191.8 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE <u>SPACE RESEARCH (passive)</u> S5.341 S5.554 MOD S5.340 | |
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Reason: The band 174.8-191.8 GHz is of crucial importance for passive sensing of the water vapour absorption line whose peak is at 183.31 GHz. Sharing with fixed and mobile

services is not practical, so these services are relocated. The inter-satellite service needs to be limited to links between GSO satellites and to a pfd limit as specified in sharing studies. Footnote **S5.YYY** is added to reflect this requirement. The entire band is deleted from those listed under **S5.149**, **S5.385** (secondary radio astronomy allocation). All applicable footnotes are appropriately modified. Since no terrestrial radio astronomy use of the band 182-185 GHz is possible due to high atmospheric absorption, the radio astronomy allocation is deleted. Active services are moved from the 190-191.8 GHz band to make room for the addition of passive sensor allocations. The footnote **S5.554** is deleted from this band, to reflect removal of active services, and modified to reflect this change. **S5.341** does not apply to this band and is deleted. The footnote **S5.340** has been modified to include this band.

GHz

191.8 – 200

../1.16/ 153
MOD

| Allocation to Services | | |
|---------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| <u>191.8 – 200</u> | <u>FIXED MOD S5.553</u> <u>INTER-SATELLITE</u> MOBILE MOD S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.341 MOD S5.554 | |

Reason: Inter-satellite and fixed service allocations added to compensate for deletions from other bands. The footnotes **S5.553** and **S5.554** modified to reflect deletion of terrestrial services from 190.0 -191.8 GHz band, and to include stations in the fixed service, allocated to the 191.8-200 GHz band.

GHz
200 – 209

**../1.16/ 154
MOD**

| Allocation to Services | | |
|-------------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 200 – 202 | EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE <u>RADIO ASTRONOMY</u> SPACE RESEARCH (passive) <u>MOD S5.340</u> S5.341 | |
| 202 – 21709 | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (Earth to space) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> <u>MOD S5.340</u> S5.341 | |

**../1.16/ 155
MOD**

Reason: This band is the optimum band for microwave limb sounding of water vapour and other atmospheric constituents in the low troposphere. Fixed and mobile services as well as the fixed-satellite uplink in the 202-209 GHz band are all relocated to meet this requirement. Footnote **S5.340** is consequentially modified, to include this band. A radio astronomy allocation has been added to satisfy the requirement for radio astronomy spectral line and wide band continuum observations.

../1.16/ 156
MOD

GHz
209 – 217

| Allocation to Services | | |
|-------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| <u>209 – 217</u> | FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY</u> <u>MOD S5.149</u> S5.341 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. This band has been added to those listed under **S5.149**.

../1.16/ 157
MOD

GHz
217 – 226

| Allocation to Services | | |
|--------------------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| <u>217 – 23126</u> | EARTH EXPLORATION SATELLITE (passive) <u>FIXED</u> <u>FIXED-SATELLITE (Earth-to-space)</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) <u>ADD S5.CCC</u> <u>MOD S5.149</u> S5.340 S5.341 | |

Reason: Passive sensors do not need this band and the EESS allocation is deleted. Fixed and mobile services and fixed-satellite uplinks are moved to this band from other locations. This band is no longer passive; consequentially it now needs to be listed under footnote **S5.149**. This band has been removed from footnote **S5.340** and footnote **S5.340** has been deleted from this band.

../1.16/ 158
MOD

../1.16/ 159
MOD

| GHz 226 – 231.5 | | |
|------------------------|---|----------|
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>226 – 231</u> | EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341 | |
| <u>231 – 231.5</u> | <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> Radiolocation <u>MOD S5.340</u> S5.341 | |

Reason: It is essential to maintain the 226-231.5 GHz band passive. The **MOD** refers to the band limits only; no change (**NOC**) is proposed to the allocations within this sub-band. Passive sensors require exclusive use of only the 226-231.5 GHz portion of the 217-231 GHz band for microwave limb sounding of atmospheric constituents. In addition, this band contains a 4 GHz reference window for higher frequency water vapor measurements. This band is of vital importance to the radio astronomy service for observations of the 230.5 GHz CO line. The footnote **S5.340** is modified to take into account that 217-226 GHz band is no longer passive, while adding the 231-231.5 GHz band. The fixed and mobile services, as well as the fixed-satellite downlinks, have been deleted from the 231-231.5 GHz portion to allow passive observations in this band.

../1.16/ 160
MOD

| GHz 231.5 – 235 | | |
|------------------------|--|----------|
| Allocation to Services | | |
| Region 1 | Region 2 | Region 3 |
| <u>231.5 – 235</u> | FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation | |

Reason: The only required change in this band is the 500 MHz upward adjustment of the lower band edge (see the previous modification).

../1.16/ 161
MOD

GHz
235 – 238

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 235 – 238 | EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIO ASTRONOMY</u> SPACE RESEARCH (passive) | |

Reason: Passive sensors are limited to microwave limb sounding in the band 235-238 GHz and can share with terrestrial services due to the absorption characteristics of this band. The fixed-satellite downlink is not compatible with the radio astronomy requirement for this band and is reallocated elsewhere. The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide.

GHz
238 – 241

../1.16/ 162
MOD

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 238 – 241 | FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIOLOCATION</u> <u>RADIONAVIGATION</u> <u>RADIONAVIGATION-SATELLITE</u> Radiolocation | |

Reason: Additional allocations to the radiolocation, radionavigation and radionavigation-satellite services, to compensate for allocation changes in the 150-160 GHz frequency range.

../1.16/ 163
MOD

GHz
241 – 248

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 241 – 248 | RADIOLOCATION <u>RADIO ASTRONOMY</u> Amateur Amateur-Satellite S5.138 MOD S5.149 | |

Reason: The addition of a radio astronomy allocation and **RES RAS** satisfies the requirements for radio astronomy spectral line and wide band continuum observations from remote locations world-wide. This band is added to those listed under footnote **S5.149**. There is no change in sharing between existing services, except for the introduction of the radio astronomy service allocation in band.

../1.16/ 164
MOD

GHz
248 – 250

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 248 – 250 | AMATEUR AMATEUR-SATELLITE <u>Radio Astronomy</u> | |

Reason: The radio astronomy service allocation is added on a secondary basis.

../1.16/ 165
MOD

GHz
250 – 252

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 250 – 252 | EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) <u>RADIO ASTRONOMY</u> S5.149 – S5.555 MOD S5.340 | |

Reason: Microwave limb sounding of nitrous oxide near 251 GHz defines the passive-sensing requirement for this band. Radio astronomy is added to the other passive services. The addition of another passive service does not alter sharing scenario. The footnotes **S5.149** and **S5.555** are consequentially deleted and band lists in these footnotes are appropriately modified. The footnote **S5.340** is added to reflect the passive nature of band.

../1.16/ 166
MOD

GHz
252 – 265

| Allocation to Services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 252 – 265 | <u>FIXED MOD S5.553</u> MOBILE MOD S5.553 MOBILE-SATELLITE (<u>Earth-to-space</u>) RADIONAVIGATION RADIONAVIGATION-SATELLITE <u>RADIO ASTRONOMY</u> MOD S5.149 S5.385 S5.554 S5.555 S5.564 | |

Reason: The fixed service is relocated to this band due to other allocation actions in other bands. The addition of a radio astronomy allocation, along with **RES RAS**, satisfy requirements for radio astronomy spectral line (current secondary allocation to radio astronomy at 257.5 - 258 GHz deleted) and wide band continuum observations from remote locations worldwide. The directional indicator added to mobile-satellite service allocation, which is paired with allocation in the 190-200 GHz band. Atmospheric absorption in the 252-265 GHz band is relatively constant and somewhat higher than in the paired downlink band. This entire band is added to those listed under footnote **S5.149**, and the band is deleted from **S5.385** and **S5.555**. The footnotes **S5.385** and **S5.555** have been modified to reflect changes. The footnote **S5.564** is no longer needed in this band due to the worldwide nature of the radio astronomy allocation.

../1.16/ 167
NOC

GHz
265 – 275

| Allocation to Services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 265 – 275 | FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY MOD S5.149 | |

GHz

275 – 400

../1.16/ 168
MOD

| Allocation to Services | | |
|---|----------|----------|
| Region 1 | Region 2 | Region 3 |
| 275 – 400 <u>1000</u> (Not allocated) MOD S5.565 | | |

Reason: The change of the upper limit for applicability of footnote **MOD S5.565** is to account for various passive service needs above 275 GHz that have been identified by administrations. Many lines and windows required for radio astronomy observations and passive remote sensing of the Earth exist above 275 GHz.

../1.16/ 169
MOD

S5.149 In making assignments to stations of other services to which the bands:

| | | |
|-----------------------|---------------------------------|---------------------------------|
| 13 360-13 410 kHz, | 42.77-42.87 GHz*, | <u>252-265 GHz</u> |
| 25 550-25 670 kHz, | 43.07-43.17 GHz*, | 265-275 GHz, |
| 37.5-38.25 MHz, | 43.37-43.47 GHz*, | 265.64-266.16 GHz* , |
| 73-74.6 MHz in | 48.94-49.04 GHz*, | 267.34-267.86 GHz* , |
| Regions 1 and 3, | 72.77-72.91 GHz* , | 271.74-272.26 GHz |
| 150.05-153 MHz in | <u>76.5-81.5 GHz</u> | |
| Region 1, | <u>81.5-84.5 GHz</u> , | |
| 322-328.6 MHz*, | <u>84.5-86 GHz</u> | |
| 406.1-410 MHz, | 93.07-93.27 GHz* , | |
| 608-614 MHz in | <u>92-94 GHz</u> , | |
| Regions 1 and 3, | <u>94.1-95 GHz</u> , | |
| 1 330-1 400 MHz*, | <u>95-100 GHz</u> , | |
| 1 610.6-1 613.8 MHz*, | 97.88-98.08 GHz* , | |
| 1 660-1 670 MHz, | <u>100-102 GHz</u> , | |
| 1 718.8-1 722.2 MHz*, | <u>102-105 GHz</u> , | |
| 2 655-2 690 MHz, | <u>105-109.5 GHz</u> | |
| 3 260-3 267 MHz*, | <u>111.8-114.25 GHz</u> | |
| 3 332-3 339 MHz*, | 140.69-140.98 GHz*, | |
| 3 345.8-3 352.5 MHz*, | <u>141-148.5 GHz</u> , | |
| 4 825-4 835 MHz*, | <u>148.5-151.5 GHz</u> | |
| 4 950-4 990 MHz, | 144.68-144.98 GHz* , | |
| 4 990-5 000 MHz, | 145.45-145.75 GHz* , | |
| 6 650-6 675.2 MHz*, | 146.82-147.12 GHz* , | |
| 10.6-10.68 GHz, | 150-151 GHz* , | |
| 14.47-14.5 GHz*, | 174.42-175.02 GHz*, | |
| 22.01-22.21 GHz*, | 177-177.4 GHz*, | |
| 22.21-22.5 GHz, | 178.2-178.6 GHz*, | |
| 22.81-22.86 GHz*, | 181-181.46 GHz*, | |
| 23.07-23.12 GHz*, | 186.2-186.6 GHz* , | |
| 31.2-31.3 GHz, | <u>209-226 GHz</u> | |
| 31.5-31.8 GHz in | 250-251 GHz* , | |
| Regions 1 and 3, | 257.5-258 GHz* , | |
| 36.43-36.5 GHz*, | 261-265 GHz , | |
| 42.5-43.5 GHz, | 262.24-262.76 GHz* , | |

- * are allocated (* indicates radio astronomy use for spectral line observations), administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **S4.5** and **S4.6** and Article **S29**).

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

**../1.16/ 170
MOD**

S5.340 All emissions are prohibited in the following bands:

| | |
|--------------------------------|--|
| 1 400 - 1 427 MHz, | |
| 2 690 - 2 700 MHz | except those provided for by Nos. S5.421 and S5.422 , |
| 10.68 - 10.7 GHz | except those provided for by No. S5.483 , |
| 15.35 - 15.4 GHz | except those provided for by No. S5.511 , |
| 23.6 - 24 GHz, | |
| 31.3 - 31.5 GHz, | |
| 31.5 - 31.8 GHz | in Region 2, |
| 48.94 - 49.04 GHz | from airborne stations, |
| 50.2 - 50.4 ¹ GHz | except those provided for by No. S5.555A , |
| 52.6 - 54.25 GHz | |
| 86 - 92 GHz, | |
| 105 - 116 GHz, | |
| <u>109.5 - 111.8 GHz,</u> | |
| <u>114.25 - 116 GHz,</u> | |
| 140.69 - 140.98 GHz | from airborne stations and from space stations in the space to- |
| Earth direction, | |
| <u>148.5-151.5 GHz,</u> | |
| <u>164 - 167 GHz,</u> | |
| 182 - 185 GHz | except those provided for by No. S5.563 , |
| <u>190 - 191.8 GHz,</u> | |
| <u>200 - 202 GHz</u> | |
| <u>202 - 209 GHz</u> | |
| 217 - 228 GHz, | |
| <u>226 - 231.5 GHz,</u> | |
| <u>250 - 252 GHz.</u> | |

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/ 171
NOC

S5.341 In the bands 1 400 - 1 727 MHz, 101 - 120 GHz and 197 - 220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.

Reason: This informational footnote is still accurate.

../1.16/ 172
MOD

S5.385 *Additional allocation:* the bands 1 718.8 - 1 722.2 MHz, ~~150—151 GHz, 174.42—175.02 GHz, 177—177.4 GHz, 178.2—178.6 GHz, 181—181.46 GHz, and 186.2—186.6 GHz~~ and 257.5—258 GHz are is also allocated to the radio astronomy service on a secondary basis for spectral line observations.

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/ 173
MOD

S5.553 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 - 100 GHz, ~~134—142 GHz, 190—191.8 - 200 GHz and 252 - 265 GHz~~, stations in the fixed and land mobile service may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. **S5.43**).

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/174
MOD

S5.554 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 - 100 GHz, ~~134—142—126 - 134 GHz, 190—191.8 - 200 GHz and 252 - 265 GHz~~, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/ 175
MOD

S5.555 *Additional allocation:* the bands 48.94 - 49.04 GHz, ~~97.88—98.08 GHz, 140.69—140.98 GHz, 144.68—144.98 GHz, 145.45—145.75 GHz, 146.82—147.12 GHz, 250—251 GHz and 262.24—262.76 GHz~~ are is also allocated to the radio astronomy service on a primary basis.

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/ 176
MOD

S5.556 In the bands 51.4 - 54.25 GHz, 58.2 - 59 GHz, and 64 - 65 GHz, ~~72.77—72.91 GHz and 93.07—93.27 GHz~~, radio astronomy observations may be carried out under national arrangements.

Reason: The changes to this footnote are consequential to the changes made to the related allocations.

../1.16/ 177
MOD

S5.558 In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, ~~123—134~~ 122.5 - 126 GHz, 170—182 167—174.8 GHz and 185-190 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

Reason: The changes to this footnote are consequential to the changes made to the related allocation.

../1.16/ 178
MOD

S5.559 In the bands 59 - 64 GHz and ~~126 – 134 GHz~~, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

Reason: The changes to this footnote are consequential to the changes made to the related allocation. The radiolocation and inter-satellite services are no longer co-allocated in this spectral region.

../1.16/ 179
NOC

S5.560 In the band 78 - 79 GHz radars located on space stations may be operated on a primary basis in the earth exploration-satellite service and in the space research service.

Reason: No change is required to this footnote

../1.16/ 180
MOD

S5.561 In the band ~~84 – 86~~ 74 - 76 GHz, stations in the fixed, and mobile ~~and broadcasting~~ services shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

Reason: The broadcasting satellite allocation has been transferred to the 74-76 GHz band and the broadcasting and broadcasting satellite services are no longer co-allocated.

../1.16/ 181
NOC

S5.562 The use of the band 94-94.1 GHz by the earth exploration-satellite (active) and space research (active) services is limited to spaceborne cloud radars.

Reason: This footnote was the result of allocation decisions made at WRC-97 and no change is needed.

../1.16/ 182
SUP

~~**S5.564** Additional allocation: in Germany, Argentina, Spain, Finland, France, India, Italy, the Netherlands and Sweden, the band 261 – 265 GHz is also allocated to the radio astronomy service on a primary basis.~~

Reason: The radio astronomy allocation is now worldwide in the 261-265 GHz band, therefore a country footnote is no longer needed.

../1.16/ 183
MOD

S5.565 The frequency band 275 - 400 1000GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:

- radio astronomy service: ~~278 – 280 GHz and 343 – 348~~ 275 - 323, 327-371, 388 - 434 GHz, 426 - 442 GHz, 453 - 510 GHz, 623 - 711 GHz, and 795 - 909 GHz
- Earth exploration-satellite service (passive) and space research service (passive): 275 - 277 GHz, ~~300~~294 – 3026 GHz, ~~324~~16 – 32634 GHz, ~~345~~2 – 3479 GHz, 363 – 365 GHz, and ~~379~~1 – 3819 GHz, 416 – 434 GHz, 442 – 444 GHz, 496 – 506 GHz, 546 – 568 GHz, 624 – 629 GHz, 634 – 654 GHz, 659 – 661 GHz, ~~684 – 692~~ 684 – 692 GHz, 730 – 732 GHz, 851 – 853 GHz and 951 – 956 GHz.

Future research in this largely unexplored spectral region may yield additional spectral lines and continuum bands of interest to the passive services. Administrations are urged to

take all practicable steps to protect these passive services from harmful interference until the next competent world radio conference.

Reason: These additional bands have been identified by various administrations as bands that will also be used for radio astronomy observations and spaceborne passive remote sensing.

**../1.16/ 184
ADD**

S5.AAA In the band 155.5 - 158.5 GHz, the allocation to the Earth exploration-satellite (passive) and space research (passive) services shall terminate on 1 January 2018.

Reason: This allocation will not be needed by passive sensors after the termination date. By the termination date, all passive sensors will have transitioned to the 148.5 - 151.5 GHz band.

**../1.16/ 185
ADD**

S5.BBB The date of entry for the allocation to the fixed and mobile services in the band 155.5 - 158.5 GHz shall be 1 January 2018.

Reason: Passive sensors require the use of this band until 1 January 2018.

**../1.16/ 186
ADD**

S5.CCC Use of this allocation is limited to space-based radio astronomy only.

Reason: This band is a likely candidate for a future space based radio astronomy mission. No other space research use is contemplated.

**../1.16/ 187
ADD**

S5.DDD The 81 - 81.5 GHz band is also allocated to the amateur and amateur-satellite services on a secondary basis.

Reason: Amateur allocation

**../1.16/ 188
ADD**

S5.EEE The band 75.5-76 GHz is also allocated to the amateur and amateur-satellite services on a primary basis until the year 200[6].

Reason: Amateur allocation

**../1.16/ 189
ADD**

S5.YYY Use of the bands 174.5-182 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed -144 dBW/m²/MHz for all angles of arrival.

Reason: This footnote is required to protect passive sensors operating in this band.

**../1.16/ 190
ADD**

S5.XXX Use of the bands 116-123 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km to 1000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed -148 dBW/m²/MHz for all angles of arrival.

Reason: This footnote is required to protect passive sensors operating in this band.

RESOLUTION RAS

USE OF THE BANDS [] BY THE RADIO ASTRONOMY SERVICE

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that a large number of spectral lines of astrophysical interest above 71 GHz provide unique information about cosmic processes, such as the chemistry of the interstellar medium and the formation of stars and planets, and that this information cannot be obtained from any other source;
- b) that Doppler shifted lines, which are also of great interest for astronomical studies, are found far removed from the rest frequency of some spectral lines and that highly Doppler shifted lines may offer the only means to obtain information about the very early Universe and the formation of galaxies;
- c) that mm-wave radio astronomy receivers are designed to cover substantial portions of the atmospheric windows above 70 GHz to take advantage of the information contained in spectral lines, as well as in continuum radiation;
- d) that several Administrations operate mm-wave radio astronomy observatories and that some are building or are planning to build a limited number of large new facilities to exploit the most advanced technologies; and that these facilities are intended to serve the needs of the worldwide scientific community;
- f) that mm-wave observatories must be located on high mountain tops or plateaus to take advantage of the driest possible atmospheric conditions necessary to obtain high quality observations; and require substantial investments on behalf of the scientific communities concerned, and that therefore their number will remain low,

noting

that sharing between the radio astronomy service and other terrestrial services operating in bands above 71 GHz is facilitated by the natural attenuation provided by atmospheric gases, and that it can be further facilitated by adequate geographic separation,

urges:

Administrations to establish coordination zones around mm-wave radio astronomy sites operating in bands above 71 GHz. Coordination zone radii should be determined following the procedure outlined in Rec. ITU-R RA.1031-1, separately for ground based transmitters, airborne transmitters and transmitters that may be located on High Altitude Platforms (HAPS).

resolves:

1. that in the frequency bands referred to in this Resolution, co-primary status of the radio astronomy service shall be recognized within coordination zones established by

Administrations. No coordination requirements should be imposed upon terrestrial services outside established coordination zones.

2. that in the bands referred to in this Resolution, co-primary services operating stations within a coordination zone should coordinate their operations with affected radio astronomy stations within five years of the date of notification of the radio astronomy site to the Radiocommunication Bureau

Annex 1 lists the radio astronomy sites that operate, or plan to operate in the bands referred to in this Resolution as of [June 8, 2000]. Observatories that operate only up to 92 GHz are identified with *** under the SITE column.

[Annex 1]*

**List of Radio Astronomical Observatories Operating
in Bands Above 71 GHz**

REGION 1

| COUNTRY | SITE | LONG o ' " | LAT o ' " | ALT (m) | DIAM (m) | Remarks |
|----------------|---|--|---|---|-------------------------|------------------------------|
| Finland | Metsahovi | 24 23 17 | 60 13 04 | 61 | 13.7 | |
| France | Bordeaux Plateau de Bure¹ | -00 31 37 05 54 26 | 44 50 10 44 38 01 | 73 2552 | 2.5 15 | |
| Germany | Effelsberg | 06 53 00 | 50 31 32 | 369 | 100 | |
| Italy | Medicina*** Noto*** | 11 38 43 15 03 00 | 44 31 14 36 31 48 | 44 | 32 | EVLBI EVLBI |
| Russia | Zelenchukskaya | 41 26 30 | 43 39 12 | 2100 | | |
| Spain | Pico Veleta Robledo Yepes | -03 23 34 -04 14 57 -03 06 00 | 37 03 58 40 25 38 40 31 30 | 2870 761 931 | 30 | |
| Turkey | Gebse-Kocaeli | 29 26 52 | 40 47 06 | 200 | | |

The Observatoire de Plateau de Bure interferometer consists of 3 antennas of 15 m diameter.

* ALL OF ANNEX 1 SHOULD BE CONSIDERED IN []

REGION 2

| COUNTRY | SITE | LONG. o ' " | LAT. o ' " | ALT (m) | DIAM (m) | REMARK S |
|-----------|--|--|---|------------------------------|-------------|---|
| Argentina | El Leoncito (SJ) | 69° 18'07" | 31°47'57" | 2552 | 1,5 | Solar telescope Sub mm |
| Chile | San Pedro de Atacama La Silla Las Campanas Pampa La Bola | 67 44 00 70 44 04 70 41 10 67 42 00 | -23 02 -29 15 34 -29 01 43 -22 58 00 | 5000 2300 2440 4800 | 15 4 | MMA (planned) ² SEST LMSA (planned) ³ |
| Mexico | Sierra Negra | 97 18 00 | 18 59 00 | 4500 | 50 | Large Millimeter Telescope (LMT- under constructio n) |

² The USA MMA (MilliMeter Array) will consist of 40 antennas of 8-m diameter, on a ring configuration. The diameter of the ring will be capable of variation, ranging from 80 m to 10 km across.

³ The Japanese LMSA (Large Southern Millimeter Array) will consist of 50 antennas of 10-m diameter.

| COUNTRY | SITE | LONG. o ' " | LAT. o ' " | ALT (m) | DIAM (m) | REMARK S |
|---------|-------------------|----------------|---------------|------------|-------------|----------------------|
| IAP | Green | 79 50 24 | 38 25 59 | 946 | 100 | NRAO- |
| | Bank,WVA *** | 107 37 | 34 04 44 | 2155 | 25 | GBT |
| | Socorro, NM *** | 06 | ..... | ..... | ..... | NRAO- |
|  | ..... | ..... | 17 45 24 | .. | 25 | VLA ⁴ |
| | St. Croix, VI *** | 64 35 01 | 42 56 01 | 46 | 25 | ..... |
| | Hancock, NH *** | 71 59 12 | | 340 | | . |
| | North Liberty, | | 41 46 17 | | 25 | NRAO |
| | IO*** | 91 34 27 | 30 38 06 | 272 | 25 | VLBA ⁵ |
| | Ft. Davis, TX *** | | | 1646 | | NRAO |
| | Los Alamos, | 103 56 | 35 46 31 | | 25 | VLBA |
| | NM | 41 | 34 18 04 | 1997 | 25 | NRAO |
| | *** | 106 14 | 31 57 23 | 2402 | 25 | VLBA |
| | Pie Town, NM | 44 | | 1946 | | NRAO |
| | *** | 108 07 | 37 13 54 | | 25 | VLBA |
| | Kitt Peak, AZ | 09 | 48 07 52 | 1237 | 25 | NRAO |
| | *** | | | 286 | | VLBA |
| | Owens Valley, | 111 36 | 19 48 05 | | 25 | NRAO |
| | CA*** | 45 | ..... | 3751 | ..... | VLBA |
| | Brewster, WA | 118 16 | 31 57 10 | ..... | 12 | NRAO |
| | *** | 37 | 42 23 33 | .. | 13.7 | VLBA |
| | Mauna Kea, | 119 41 | | 1930 | | |
| | HI | 00 | 37 13 54 | 314 | 10.4 | NRAO |
| | *** | 155 27 | 40 49 04 | | 6.1 | VLBA |
|  | ..... | 19 | 42 37 23 | 1236 | 36 | NRAO |
| | Kitt Peak, AZ | ..... | 19 49 33 | 1042 | 10.4 | VLBA |
| | Amherst, MA | 111 36 | | 122 | | |
| | Owens Valley, | 50 | | 4000 | | NRAO |
| | CA | 72 20 40 | | | | VLBA |
| | Hat Creek, CA |  |  |  |  | ..... |
| | Westford, MA | 118 17 | | | | NRAO 12 |
| | Mauna Kea, HI | 36 | | | | m |
| | Mauna Kea, HI | 121 28 | | | | FCRAO |
| | | 24 | | | | (Five |
| | | 71 29 19 | | | | Colleges |
| | | 155 28 20 | | | | Obs.) |
| | | | | | | Caltech ⁶ |
| | | | | | | BIMA ⁷ |
| | | | | | | Haystack |
| | | | | | | Obs. |
| | | | | | | J.C. |
| | | | | | | Maxwell |
| | | | | | | Tel. |
| | | | | | | CSO |

REGION 3

| COUNTRY | SITE | LONG. o ' " | LAT. o ' " | ALT . m | DIAM m | REMARKS |
|-----------|---|--|--|---------------------------------------|----------------------------------|--|
| AUSTRALIA | Parkes Mopra Narrabri, NSW | 148 15 44 149 05 58 149 32 56 | -33 00 00 -31 16 04 -30 59 52 | 60 | 64 | Austr. Tel. Compact Array |
| CHINA | Delingha | 97 43 75 | 37 22 43 | 3200 | 13.7 | |
| JAPAN | Nobeyama ⁸ Kashima Mizusawa Nagoya Mt. Fuji Kagoshima | 138 28 32 140 39 46 141 08 09 136 58 24 138 45 06 130 26 32 | 35 56 29 35 57 15 39 08 00 35 08 55 35 21 30 31 44 52 | 1350 50 87 70 3776 520 | 45 34 10 4 1.2 20 | Comm. Res. Lab. Only >300GHz VERA (planned) |
| KOREA | Taejon | 127 22 18 | 36 23 54 | 120 | 13.7 | |

Other

| COUNTRY | SITE | LONG. o ' " | LAT. o ' " | ALT. m | DIAM m | REMARKS |
|---------|------------|----------------|---------------|-----------|-----------|---------|
| | ANTARCTICA | | -90 00 00 | | | |

Reason: RES RAS sets out the details of the limitation on the radio astronomy service. Annex 1 lists the observatories that operate in the radio astronomy service in bands shared with terrestrial services above 71 GHz at the time of WRC-00.

DRAFT RESOLUTION XXX (WRC-2000)

**CONSIDERATION BY A FUTURE WORLD
RADIOCOMMUNICATION CONFERENCE OF ISSUES DEALING
WITH SHARING BETWEEN PASSIVE AND ACTIVE SERVICES 71GHz**

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that the changes made to the table of allocations by WRC-2000 in bands above 71 GHz were based on the requirements known at the time of the conference;
- b) that the passive service spectrum requirements above 71 GHz are based on physical phenomenon and therefore are well known. These requirements are reflected in the changes made to the table of allocations by WRC-2000;
- c) that several bands above 71 GHz are already used by EESS (passive) and SR (passive) because they are unique bands to measure specific atmospheric parameters;
- d) that currently there is only limited knowledge of requirements and implementation plans for the active services to operate in bands above 71 GHz;
- e) that in the past, technological developments have led to viable communication systems operating at increasingly higher frequencies and this can be expected to continue so as to make communication technology available in the future for the frequency bands above 71 GHz;
- f) that in the future, there should be accommodation of alternative spectrum needs of the active and passive services when the new technologies become available;
- g) that, following the revisions to the table of allocations by WRC-2000, sharing studies may be required for services in some bands above 71 GHz;
- h) that interference criteria for passive sensors have been developed and are given in ITU-R SA.1029-1;
- j) that sharing criteria for active and passive services in bands above 71 GHz have not yet fully developed within the ITU-R;
- k) that in order to ensure the protection of passive services above 71 GHz WRC-2000 avoided co-allocations of active and passive services to prevent potential sharing problems;

recognizing

that to the extent practicable, the burden of sharing among active and passive services should be equitably distributed amongst the allocated services;

invites ITU-R

- 1) continue its studies to determine if sharing is possible between active and passive services in the bands above 71 GHz;
- 2) to take into account the principles of burden sharing to the extent practicable in their studies;
- 3) complete the necessary studies, as soon as the technical characteristics of the active services in these bands are known;
- 4) develop recommendations specifying sharing criteria for those bands where sharing is feasible.

resolves

that a future competent conference should consider the results of ITU-R studies with a view to revise as appropriate the Radio Regulations in order to accommodate the emerging requirements of the active services taking into account the requirements of the passive services, in bands above 71 GHz;

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION YYY (WRC-2000)

**CONSIDERATION BY A FUTURE COMPETENT WORLD
RADIOCOMMUNICATION CONFERENCE OF ISSUES DEALING WITH
SHARING BETWEEN ACTIVE SERVICES ABOVE 71 GHz**

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that WRC-2000 made changes to the table of allocations above 71 GHz, following consideration of science service issues;
- b) that there are several co-primary active services in some bands above 71 GHz in the table of allocations as revised by WRC-2000;
- c) that there is limited knowledge of characteristics of active services that may be developed to operate in bands above 71 GHz;
- d) that sharing criteria for sharing between active services in bands above 71 GHz have not yet been fully developed within the ITU-R;
- e) that sharing between multiple co-primary active services may hinder the development of each active service in bands above 71 GHz;
- f) that the technology for some active services may be commercially available earlier than for some other active services;
- g) that adequate spectrum should be available for the active services for which the technology is available at a later time;

noting

that sharing criteria need to be developed, to be used by a future Conference, for determining to what extent sharing between multiple co-primary active services is possible in each of the bands;

resolves

1. that appropriate measures should be taken to fulfill the spectrum requirements for active services for which the technology is commercially available at a later time;
2. that sharing criteria be developed for co-primary active services in bands above 71 GHz;
3. that the sharing criteria developed should form a basis for a review of active service allocations above 71 GHz at a future conference, if necessary;

requests ITU-R

to complete the necessary studies with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of a future competent Conference;

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

Reasons: There is no consensus whether sharing between the passive services and the active services is feasible in many of the bands above 71 GHz. This is because there is a lack of information available on these active services in this frequency range. New Resolution XXX has been added which calls for ITU-R studies on sharing between active and passive services in bands above 71 GHz. Similarly, sharing conditions between many of the relocated active services above 71 GHz are not known and need to be developed and Resolution YYY calls for studies that can develop sharing criteria and should form a basis for a review of active service allocations above 71 GHz at a future conference, if necessary

WRC-2000 Agenda Item 1.17

To consider possible worldwide allocation for the earth exploration-satellite (passive) and space research (passive) service in the band 18.6 - 18.8 GHz, taking into account the results of the ITU-R studies

Proposal for worldwide allocation to the Earth exploration-satellite (passive) services in the band 18.6-18.8 GHz on a primary basis

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, Mexico, United States

Background Information: At present, the allocations for the Earth exploration-satellite (passive) and the space research (passive) services in the band 18.6 - 18.8 GHz are on a primary basis in Region 2, but on a secondary basis in Regions 1 and 3.

The allocation to the Earth exploration-satellite (passive) service must be upgraded to primary status if the long-term ability to obtain environmental data with passive spaceborne sensors is to be preserved. Compatibility between the passive sensors and the fixed and fixed-satellite services requires adoption of constraints on the parameters of the fixed and fixed-satellite systems that use the band.

A pfd limit of -95 dBW/m^2 in a reference bandwidth of 200 MHz on geostationary systems in the fixed-satellite service will enable passive sensors to perform their mission if measurements are restricted to portions of the sensor orbit where the sensor is moving away from the equator while taking sensor data over land masses. Additionally, allowing for an exceedance of this value by 3dB for up to 5 % of the time will allow the fixed satellite service to implement power control in overcoming rain fades when needed.

Similarly, limiting the power delivered to any antenna of a station in the fixed service measured across the band 18.6 - 18.8 GHz to not exceed 0 dBW in 200 MHz along with an antenna pattern complying with Recommendation ITU-R F.699-4 will enable sharing with the fixed service.

Proposal(s):

../1.17/195
IAP/1.17/53
MOD

GHz
18.6 – 18.8

| Allocation to Services | | |
|--|---|--|
| Region 1 | Region 2 | Region 3 |
| 18.6 – 18.8 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile Earth Exploration Satellite (passive) Space Research (passive) MOD S5.522 | 18.6 – 18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile SPACE RESEARCH (passive) MOD S5.522 | 18.6 – 18.8 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile Earth Exploration Satellite (passive) Space Research (passive) MOD S5.522 |

Reasons : To establish a common worldwide primary allocation to the Earth exploration-satellite (passive) services to be used for environmental measurements.

../1.17/196
IAP/1.17/54
MOD

~~**S5.522** In making assignments to stations in the fixed and mobile services, administrations are invited to take account of passive sensors in the Earth exploration-satellite and space research services operating in the band 18.6 – 18.8 GHz. In this band, administrations should endeavour to limit as far as possible both the power delivered by the transmitter to the antenna and the e.i.r.p. in order to reduce the risk of interference to passive sensors to the minimum. In the band 18.6 - 18.8 GHz, fixed and mobile service stations shall be limited to a total power delivered to each antenna of 0 dBW.~~

Reasons: To enable passive sensors and the fixed service to operate in the band without excessive interference to the sensors.

../1.17/197
IAP/1.17/55
MOD

~~**S5.523** In assigning frequencies to stations in the fixed-satellite service in the direction space-to-Earth, administrations are requested to limit as far as practicable the power flux-density at the Earth's surface in the band 18.6-18.8 GHz, in order to reduce the risk of interference to passive sensors in the earth-exploration-satellite and space research services. The fixed-satellite service shall be limited to a power flux-density at the Earth's surface of -95 (dBW/m²) across the 18.6-18.8 GHz band for all angles of arrival. This power flux-density limit may be exceeded by 3dB for up to 5% of the time everywhere in the FSS service area. The use of this band by non-geostationary-satellite orbit fixed~~

satellite service systems with apogees lower than 20,000 km shall be in accordance with the provisions of Resolution ZZZ (WRC-2000).

Reasons: To enable passive sensors and the fixed-satellite service to operate in the band without excessive interference to the sensors. Further, studies have not been completed to determine an allowable power flux-density limit on non-geostationary fixed satellite service systems needed to protect Earth exploration-satellite service (passive).

DRAFT RESOLUTION ZZZ (WRC-2000)

**Power flux-density limits applicable to NON-GSO systems
for protection of earth exploration-satellite
service (passive) in the band 18.6-18.8 GHz**

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that WRC-2000 made changes to the table of allocations in the band 18.6-18.8 GHz;
- b) that the power flux-density (pfd) limit in footnote MOD S5.523 of the Radio Regulations was derived solely upon consideration of geostationary-satellite orbit fixed-satellite service systems and non-geostationary-satellite orbit fixed-satellite service systems with apogees higher than 20,000 km;
- c) that initial sharing studies have indicated that low-Earth orbiting fixed-satellite service systems cause significantly greater interference into Earth exploration-satellite (passive) service sensors than do geostationary-satellite orbit fixed-satellite service systems;
- d) that further sharing studies are required of the power flux-density limit applicable to non-geostationary-satellite orbit fixed satellite service systems operating below 20,000 km for the protection of Earth exploration-satellite (passive) service systems,

resolves

that non-geostationary-satellite orbit fixed-satellite service systems operating with apogees below 20,000 km shall do so only on a non-interference basis until an appropriate power flux-density limit is determined for protection of EESS (passive) systems,

invites ITU-R

to study, as a matter of urgency, the appropriate power flux-density values to be applied to non-geostationary-satellite systems in the 18.6-18.8 GHz band to ensure protection of the Earth exploration-satellite (passive) service without unduly constraining the development of either type of system, and submit the results to a future competent conference,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

WRC-2000 Agenda Item 1.18

to consider the use of new digital technology for the maritime mobile service in the band 156 - 174 MHz and consequential revision of Appendix 18/S18, taking into account Resolution 342 (WRC-97);

Proposal to modify Appendix S18 and Resolution 342

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, Ecuador, Mexico, United States

Background Information: Appendix **S18** of the ITU Radio Regulations defines the channels of the maritime mobile service. These channels support a variety of functions including “Distress, Safety and Calling: public correspondence, inter-ship, ship/shore/ship, port operations and ship movement”. The maritime mobile frequency band, 156-174 MHz, (effectively 156-162 MHz in the Americas due to previous domestic regulatory actions), supports maritime communications worldwide.

WP8B and the CPM studied this agenda item and determined that the status of the ITU-R studies indicate that revisions of Appendix **S18** to introduce new digital technologies is not possible at this conference. However, it is possible to take action to address the issue of congestion.

With the rapidly increasing use of the VHF maritime mobile band, particularly for data communications, increased congestion and mutual interference is being experienced which, among others, has resulted in unacceptable degradation of the distress and safety related function for which this band is utilized. Unless action is taken this situation will only worsen as usage continue to grow.

At WRC-97, CITEL proposed simplex use of duplex channels for Appendix **S18**. This was approved for a few specific public correspondence channels only, channels 18 and 82-86. Note M to Appendix **S18** must be modified to add more channels for simplex use. This will allow for more efficient use of Appendix **S18** channels and provide flexibility for administrations to meet their immediate requirements, while maintaining compatibility with the vast number of ships and pleasure craft now using the band in accordance with Appendix **S18**.

WP8B and the CPM recommend modifications to Appendix **S18** to provide administrations with further flexibility to use the channels of Appendix **S18** in simplex mode if required. This would allow the use of duplex channels in Appendix **S18** in simplex mode and would increase the number of available channels. The cost of the change would be minimal and administrations could be able to quickly address certain local problems of congestion. Furthermore, the conference could consider permitting, subject to non-interference and no protection, the use of some of these channels or sub-bands created by the conversion of duplex channel to simplex channels for the initial testing and possible future introduction of new

technologies, subject to non-operational use. This would necessarily be subject to special arrangement between interested or affected administrations.

CITEL administrations propose to modify Note M to allow simplex use of duplex channels for the remainder of the channels not already identified as simplex. CITEL administrations also propose the addition of a new Note [Z] to allow the use of the simplex channels per Note M for the testing and development of new technologies on a non-operational basis, subject to special arrangements between affected or interested administrations.

In addition CITEL administrations propose to modify Resolution **342** to continue the study of one or more new interoperable technologies for the maritime mobile service.

Proposal(s):

APPENDIX S18
Table of transmitting frequencies in the VHF
maritime mobile band

../1.18/ 199
IAP/1.18/57
MOD

(See Article **S52**)

NOTE – For assistance in understanding the Table, see notes *a)* to *n)* below.

| Channel Designator | Notes | Transmitting frequencies (MHz) | | Inter- ship | Port operations and ship movement | | Public corres- pondence |
|-----------------------|-----------|--------------------------------------|-------------------|------------------------------|--------------------------------------|------------------|-------------------------------|
| | | Ship stations | Coast stations | | Single frequency | Two frequency | |
| 16 | | 156.800 | 156.800 | DISTRESS, SAFETY AND CALLING | | | |
| 76 | n) | 156.825 | | | x | | |
| 17 | g) | 156.850 | 156.850 | x | x | | |
| 77 | | 156.875 | | x | | | |
| 18 | m) [z] | 156.900 | 161.500 | | x | x | x |
| 78 | m) [z] | 156.925 | 161.525 | | x | x | x |
| 19 | m) [z] | 156.950 | 161.550 | | x | x | x |
| 79 | m) [z] | 156.975 | 161.575 | | x | x | x |
| 20 | m) [z] | 157.000 | 161.600 | | x | x | x |
| 80 | m) [z] | 157.025 | 161.625 | | x | x | x |
| 21 | m) [z] | 157.050 | 161.650 | | x | x | x |
| 81 | m) [z] | 157.075 | 161.675 | | x | x | x |
| 22 | m) [z] | 157.100 | 161.700 | | x | x | x |
| 82 | m) [z] | 157.125 | 161.725 | | x | x | x |
| 23 | m) | 157.150 | 161.750 | | x | x | x |

| | | | | | | | |
|-------|------------------|---------|---------|--|----------|---|---|
| | <u>[z]</u> | | | | | | |
| 83 | m) <u>[z]</u> | 157.175 | 161.775 | | x | x | x |
| 24 | m) <u>[z]</u> | 157.200 | 161.800 | | <u>x</u> | x | x |
| 84 | m) <u>[z]</u> | 157.225 | 161.825 | | x | x | x |
| 25 | m) <u>[z]</u> | 157.250 | 161.850 | | <u>x</u> | x | x |
| 85 | m) <u>[z]</u> | 157.275 | 161.875 | | x | x | x |
| 26 | m) <u>[z]</u> | 157.300 | 161.900 | | <u>x</u> | x | x |
| 86 | m) <u>[z]</u> | 157.325 | 161.925 | | x | x | x |
| 27 | m) <u>[z]</u> | 157.350 | 161.950 | | <u>x</u> | x | x |
| 87 | | 157.375 | | | x | | |
| 28 | m) <u>[z]</u> | 157.400 | 162.000 | | <u>x</u> | x | x |
| 88 | | 157.425 | | | x | | |
| AIS 1 | l) | 161.975 | 161.975 | | | | |
| AIS 2 | l) | 162.025 | 162.025 | | | | |

Notes referring to the Table

Specific notes

../1.18/ 200
IAP/1.18/58
MOD

m) These channels (~~48 and 82 to 86~~) may be operated as single frequency channels, subject to special arrangement between interested or affected administrations.

Reasons : Adding more channels for simplex use will allow for more efficient use of Appendix **S18** channels and provide flexibility for administrations to meet their immediate requirements, while maintaining compatibility with the vast number of ships and pleasure craft now using the band in accordance with Appendix **S18**.

../1.18/ 201
IAP/1.18/59
ADD

[z)] These channels may be used for the testing and development of new technologies on a non-interference, no protection, non-operational basis. Such use is subject to special arrangement between interested or affected administrations.

Reasons : May permit facilitation of the development and testing of new technology. Use of channels for the development and testing of new technologies may, in turn, encourage maritime radio equipment manufacturers to advance or accelerate such development and testing.

../1.18/ 202
IAP/1.18/60
MOD

RESOLUTION 342 (WRC-972000)

**Review of new technology to provide improved efficiency in the use of the band
156-174 MHz by stations in the maritime mobile service**

../1.18/ 203
IAP/1.18/61
MOD

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),
considering

../1.18/ 204
IAP/1.18/62
MOD

- a) that the agenda of ~~WRC-97~~ this Conference includes ~~d~~ the consideration of the use of Appendix **S18** to the Radio Regulations in respect of maritime mobile communications and the use of new technology for maritime radiotelephony channels;
- b) Recommendation **318 (Mob-87)**;
- c) that Appendix **S18** identifies frequencies to be used for distress and safety communications on an international basis;
- d) that the introduction of new technology in the maritime mobile service shall not disrupt distress and safety communications in the VHF band including those established by the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended;
- e) that ITU-R is conducting studies on improving efficiency in the use of this band, and that these studies are still ongoing;
- f) that changes made in Appendix **S18** should not prejudice the future use of these frequencies or the capabilities of systems or new applications required for use by the maritime mobile service;
- g) that the congestion on Appendix **S18** frequencies calls for the implementation of efficient new technologies;
- h) that the use of new technology on maritime VHF frequencies will make it possible to better respond to the emerging demand for new services,

noting

../1.18/ 205
IAP/1.18/63
SUP

~~a) that some administrations are considering adopting some of the above changes to their operations within the Appendix **S18** frequencies;~~

../1.18/206
IAP/1.18/64
ADD

a) that digital systems have been successfully implemented in portions of the land mobile service,

../1.18/ 207
IAP/1.18/65
ADD

b) that the use of mobile telephones (PCS and Cellular) along the coast had led to the reduced use of maritime public correspondence systems,

resolves

../1.18/ 208
IAP/1.18/66
MOD

a) that ~~WRC-99~~ a future World Radiocommunication Conference should consider the use of new technology in the band 156-174 MHz and consequential revision of Appendix **S18** if necessary;

../1.18/ 209
IAP/1.18/67
ADD

b) that in order to provide full worldwide interoperability of equipment on ships, there should be one technology or more than one interoperable worldwide technology implemented in Appendix **S18**,

invites ITU-R

../1.18/ 210
IAP/1.18/68
MOD

to continue studies on the following with a view to providing a report to ~~WRC-99~~ a future WRC and identify the future requirements of the maritime mobile service. If the requirements warrant the replacement of existing technology with new technology then:

../1.18/ 211
IAP/1.18/69
SUP

~~a) — to identify the future requirements of the maritime mobile service;~~

../1.18/ 212
IAP/1.18/70
MOD

~~b) a)~~ to identify suitable technical characteristics of the system or interoperable systems to replace existing technology;

../1.18/ 213
IAP/1.18/71
MOD

~~c) b)~~ to identify necessary modifications if required, to the frequency plan contained within Appendix **S18**;

../1.18/ 214
IAP/1.18/72
MOD

~~d) c)~~ to recommend a timetable for the introduction of new technology if required, and a transition plan ~~the necessary changes~~;

../1.18/ 215
IAP/1.18/73
MOD

~~e) d)~~ to study and recommend how new technology can be introduced without harming the distress and safety requirements,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization.

Reasons: These modifications do not restrict the new technology to digital or to one technology; all available technologies should be studied, as new technologies are constantly emerging. It is spectrally inefficient to set aside spectrum, which is already extremely congested, for a new technology that has not yet been determined.

WRC-2000 Agenda Item 1.19bis

in accordance with Article S14, to consider objections expressed by administrations with respect to the Radio Regulations Board's Rules of Procedure relating to the application of RR 2674/S23.13 in order for the Bureau to modify its findings in accordance with the conclusions of the Conference

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Colombia], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

United States

Background Information: No. S23.13 (RR2674) states that, "in devising the characteristics of a space station in the broadcasting-satellite service, all technical means available shall be used to reduce, to the maximum, the radiation over the territory of other countries unless an agreement has been previously reached with such countries." No. S23.13 (RR2674) was adopted at WARC-71. It was intended as a statement of good engineering practice to reduce BSS interference with the terrestrial services outside of the intended service area.

At WRC-95, however, some countries sought to have the interpretation of No. S23.13 (RR 2674) revised to require, as a condition for registration, the approval of other countries within the service area of a BSS system proposed as a plan modification. After thorough debate, WRC-95 instructed the RRB to revise its Rules of Procedures to reflect the results of its debate. The decision reached by WRC-95 reflected a difficult compromise on the parts of all parties involved. The RRB made the revisions, but further concerns were raised at WRC-97. These concerns led WRC-97 to adopt Resolution 536 which resolves that: "in addition to observing No. S23.13/2674, and before providing satellite broadcasting services to other administrations, administrations originating the services should obtain the agreement of those other administrations."

Still dissatisfied after a review of the RRB Rules for RR S23.13 under the "review of finding" procedures of Article S14, the concerned countries persuaded the 1998 meeting of the ITU Council to adopt new agenda item 1.19bis.

Proposal(s):

../1.19bis/ 216

Therefore, CITEL is of the view that there is no need to repeat the work and discussion of WRC-95 and WRC-97, and that Resolution 536 and RR S23.13 are sufficient. CITEL proposes that WRC-2000 not revise the present Rule of Procedure for RR S23.13/2674 to apply it retroactively, i.e., to BSS filings (under Article 4 of Appendix S30 or under Resolution 33/S9) made prior to 18 November 1995. CITEL also

supports the existing separation of Article 4 of Appendix S30 and the Rule of Procedure for RR S23.13/2674.

Reason: Agenda Item 1.19*bis* has the effect of re-opening an issue that was resolved after much discussion first at WRC-95, and then at WRC-97 by the adoption of Resolution 536.

WRC-2000 Agenda Item 1.20

to consider the issues related to the application of Nos. S9.8, S9.9 and S9.17 and the corresponding parts of Appendix S5 with respect to Appendices S30 and S30A, with a view to possible deletion of Articles 6 and 7 of Appendices S30 and S30A, also taking into consideration Recommendation 35 (WRC-95);

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Canada], [Chile], [Colombia], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

United States

Background Information: Annex 1 to Appendix S30 of the Radio Regulations specifies limits for determining whether a service is affected by a proposed modification to the BSS Plan (i.e., when it is necessary to seek the agreement of any other administration). Section 5 of Annex 1 specifies limits to the change in the PFD to protect the terrestrial services of administrations in Regions 1 and 3 from modifications to the Region 2 Plan. In particular, Section 5c specifies the PFD limits for administrations in Region 1 east of longitude 30°E. Further, through Section 8a), the pfd limits in Section 5b) of Annex 1 apply to protect terrestrial services in Regions 1 and 3 from modifications to the Regions 1 and 3 BSS Plan.

This PFD limit is very stringent at low angles of elevation. For example, in order to meet this PFD limit the BSS spacecraft power must be significantly lower in areas of western Region 2 near Region 1 (e.g., Alaska) as compared to other areas in Region 2. As a result, the provision of BSS service to these areas requires larger BSS receive dishes, in some cases as large as 2.4 m. This will be the case for Region 2 administrations that propose to modify their Plan assignments to provide service to these areas.

One CITELE Administration requires provision of BSS service to Alaska when technically feasible. A relaxation in the PFD limit in Section 5c of Annex 1 of Appendix S30, as proposed below, would allow the use of 60 cm BSS receive dishes in these areas for BSS service. The ITU-R studied possible modifications to the limits in Sections 5b) and 5c) of Annex 1. Section 5.2.3.5 of the CPM Report contains a proposed change to these limits. Consequential updates to Table 3 of Article 10 of Appendix S30 would also be required. Consistent with the CPM Report, the following changes to Section 5 of Annex 1 of Appendix S30 are proposed:⁹

APPENDIX S30

ANNEX 1

5 Limits to the change in the power flux-density to protect the terrestrial services of administrations in Regions 1 and 3¹⁶

With respect to § 4.3.3.4 of Article 4, an administration in Region 1 or 3 shall be considered as being affected if the proposed modification to the Region 2 Plan would result in the following power flux-density limits being exceeded:

- a) in the frequency band 12.2-12.7 GHz for all the territories of administrations in Regions 1¹⁷ and 3 and for any arrival angle γ :
- 125 dB(W/m²/4 kHz) for broadcasting-satellite space stations using circular polarization;
 - 128 dB(W/m²/4 kHz) for broadcasting-satellite space stations using linear polarization;
- b) in the frequency band 12.2-12.5-7 GHz for territories of administrations in Regions 1¹⁷ and 3 and those in the western part of Region 1, west of longitude 30° E¹⁸:
- 148.132 dB(W/m²/5 MHz) for $0^\circ \leq \gamma < 40.5^\circ$;
 - $132 - 148 + 0.542(\gamma - 40.5)$ dB(W/m²/5 MHz) for $40.5^\circ \leq \gamma < 45.25^\circ$;
 - 138.111 dB(W/m²/5 MHz) for $45.25^\circ \leq \gamma < 90^\circ$;
- c) in the frequency band 12.2-12.7 GHz for territories of administrations in Region 1¹⁷, east of longitude 30° E:
- 134 dB(W/m²/5 MHz) for $\gamma = 0^\circ$;
 - $134 + 4.6975 \gamma^2$ dB(W/m²/5 MHz) for $0^\circ < \gamma \leq 0.8^\circ$;
 - $128.5 + 25 \log \gamma$ dB(W/m²/5 MHz) for $\gamma > 0.8^\circ$;
- d) in the frequency band 12.5-12.7 GHz for all the territories of administrations of Regions 1¹⁷ and 3:
- 148 dB(W/m²/4 kHz) for $\gamma = 0^\circ$;
 - $148 + 4.6975 \gamma^2$ dB(W/m²/4 kHz) for $0^\circ < \gamma \leq 0.8^\circ$;
 - $142.5 + 25 \log \gamma$ dB(W/m²/4 kHz) for $\gamma > 0.8^\circ$;
- where γ is the angle of arrival of the incident wave above the horizontal plane, in degrees.

WRC-2000 Agenda Item 2

to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations in accordance with Resolution 28 (WRC-95); and decide whether or not to update the corresponding references in the Radio Regulations, in accordance with principles contained in the Annex to Resolution 27 (Rev.WRC-97)

Submitted by the following Administrations:

[Antigua and Barbuda], [Argentina], [Bahamas], [Barbados], [Belize], [Bolivia], [Brazil], [Chile], [Costa Rica], [Dominica], [Dominican Republic], [Ecuador], [El Salvador], [Grenada], [Guatemala], [Guyana], [Haiti], [Honduras], [Jamaica], [Mexico], [Nicaragua], [Panama], [Paraguay], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [St. Kitts and Nevis], [Suriname], [Trinidad and Tobago], [Uruguay], [Venezuela]

Canada, Colombia, United States

Background Information: Certain provisions of the Radio Regulations make specific reference to ITU-R Recommendations. As the ITU-R Recommendations are updated, it is necessary to determine if such references should be continued, suppressed, or updated citing the revised version of the applicable ITU-R Recommendation.

Although the principle of Incorporation by Reference is widely supported by ITU members, its implementation in practice leads to various difficulties. It is important that administrations are aware of which recommendations could be candidates for incorporation by reference into the Radio Regulations. Also, administrations need to know of any ITU-R Recommendation currently incorporated by reference, which are being (or have been) revised during the current study period. Administrations would benefit greatly by being advised of such recommendations well in advance of a WRC. Therefore, a mechanism for the early identification should be established.

In order to allow administrations as much time as possible to consult their experts and to consider the implications of updating references in the Radio Regulations, to reflect changes to Recommendations which are currently incorporated by reference, the approach outlined in 1) below is proposed. Similarly, to facilitate the work of administrations in their preparation for the possible introduction of new instances where Recommendations may be incorporated by reference into the Radio Regulations, the approach outlined in 2) below is proposed.

1) Rather than have only the Radiocommunication Assembly (RA) communicate to the WRC a list of the ITU-R Recommendations currently incorporated by reference in the Radio Regulations which have been revised and approved during the elapsed study period, the Director of the Radiocommunication Bureau should provide a report to the Conference Preparatory Meeting. This report would also include a listing of those ITU-R Recommendations currently incorporated by reference which are being revised in preparation for the RA. This report would be for information only and would not confer any special status on the Recommendations listed.

- 2) If a Recommendation is not currently incorporated by reference into the Radio Regulations, it could only be considered for incorporation by reference if it is in response to a WRC agenda item.

Proposals to modify Resolution 27 (Rev.WRC-97) and Resolution 28 (WRC-95):

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MOD

RESOLUTION 27 (Rev.WRC-972000)

References to ITU-R and ITU-T Recommendations in the Radio Regulations

The World Radiocommunication Conference (~~Geneva, 1997~~ Istanbul, 2000),

considering

- a)* that the principles of incorporation by reference were adopted by the WRC-95 and have been revised by this Conference (see Annex 1 to this Resolution);
- b)* that there are provisions of the Radio Regulations which employ mandatory incorporation by reference but fail to make explicit reference to the ITU-R or ITU-T Recommendations incorporated;
- c)* that the 1997~~9~~9Conference Preparatory Meeting (CPM-97~~99~~99) for this Conference urged administrations to give further consideration to the status of material incorporated by reference:
 - using the initial assessment provided by the Radiocommunication Bureau in the CPM Report and the set of principles given in Annex 1 to this Resolution;
 - noting that mandatory references shall be explicit and use the appropriate regulatory language;
 - taking into account the factors set out in Annex 2 to this Resolution;
- d)* that the Director of the Radiocommunication Bureau has drawn up a list (see Annex 1 to the CPM Report to this Conference) of the provisions of the Radio Regulations using incorporation by reference, which provides an initial assessment of the status of each reference and forms the basis for the work on appropriate referencing, examples of which are contained in Annex 3 to this Resolution;

e) that the Bureau has drawn up a list, contained in Annex 4 to this Resolution, of the ITU-R Recommendations to which explicit reference is made in the Radio Regulations,

resolves

that ITU-R and ITU-T Recommendations incorporated or proposed for incorporation by reference in the provisions of the Radio Regulations be identified and examined at WRC-99[2003], with a view to establishing the correct method of reference in accordance with the principles set out in Annex 1 to this Resolution and taking into account the factors listed in Annex 2 to this Resolution, in order to complete the simplification of the Radio Regulations in respect of incorporation by reference,

further resolves

that, in the case of ITU-R Recommendations which are not currently referenced in the Radio Regulations, only those Recommendations which are in response to a WRC agenda item can be considered for incorporation by reference.

instructs the Director of the Radiocommunication Bureau

to arrange for a review of the provisions of the Radio Regulations containing references to ITU-R or ITU-T Recommendations and propose suitable recommendations to the CPM-99[2002] for inclusion in its Report to WRC-99[2003], using the list of provisions contained in Annex 3 to this Resolution together with the guidance contained in Annexes 1 and 2 to this Resolution, and taking into account the list of ITU-R Recommendations contained in Annex 4 to this Resolution,

urges administrations

to use the CPM Report to WRC-99[2003] in order to prepare their proposals on incorporation by reference to that Conference.

Principles of incorporation by reference

- 1 Where references are non-mandatory, it is not necessary to establish specific conditions in applying the texts quoted. In such cases, reference could, for example, be made to “the latest version” of a Recommendation.
- 2 Mandatory references to Resolutions or Recommendations of a world radiocommunication conference (WRC) are acceptable without restriction, since such texts will have been agreed by a WRC.
- 3 Where mandatory references are suggested, and the relevant texts are brief, the referenced material should be incorporated in the body of the Radio Regulations.
- 4 If, on a case-by-case basis, it is decided to incorporate material by reference on a mandatory basis, then the following provisions shall apply:
 - 4.1 the referenced text shall have the same treaty status as the Radio Regulations themselves;
 - 4.2 the reference must be explicit, specifying the specific part of the text (if appropriate) and the version or issue number;
 - 4.3 the referenced text must be adopted by the Plenary of a competent WRC, but should not be part of the Final Acts;
 - 4.4 all texts incorporated by reference must be readily available, by being published in a separate volume;
 - 4.5 if, between WRCs, a referenced text (e.g. an ITU-R Recommendation) is updated, the reference in the Radio Regulations shall continue to apply to the original version until such time as a competent WRC agrees to incorporate the new version of the reference. The mechanism for considering such a step is given in Resolution **28 (Rev. WRC-~~95~~2000)**.

**Factors to be considered for the further application of
incorporation by reference**

In reviewing the provisions of the Radio Regulations employing references to other texts, administrations and study groups should address the following factors:

- 1 whether each reference is of mandatory, ~~i.e. incorporated by reference~~, or non-mandatory character;
- 2 whether in existing non-mandatory references, or mandatory references which are determined to be of non-mandatory character, appropriate linking language is used, e.g. the words “should” or “may”;
- 3 whether in existing mandatory references, or other types of reference which are determined to be of mandatory character, clear mandatory linking language is used, e.g. the word “shall”;
- 4 whether the incorporated ITU-R or ITU-T Recommendation(s) are explicitly identified;
- 5 where referenced ITU-R or ITU-T Recommendations are not explicitly identified, determine which ones should be identified;
- 6 whether text incorporated from ITU-R or ITU-T Recommendations should be placed directly in the Radio Regulations instead of using incorporation by reference;
- 7 if the ITU-R or ITU-T Recommendation to be incorporated is, as a whole, unsuitable as treaty status text, whether to limit the reference to those portions of the ITU-R or ITU-T Recommendation which are of a suitable nature or to place the mandatory portion directly in the Radio Regulations.

Reason: To clarify that, in the case of ITU-R Recommendations which are not currently referenced in the Radio Regulations, only those Recommendations which are in response to a WRC agenda item can be considered for incorporation by reference. Also, minor consequential editorial changes have also been identified.

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MOD

RESOLUTION 28 (Rev.WRC-952000)

**Revision of references to ITU-R Recommendations incorporated
by reference in the Radio Regulations**

The World Radiocommunication Conference (~~Geneva, 1995~~ Istanbul, 2000),

considering

- a) that the Voluntary Group of Experts on simplification of the Radio Regulations (VGE) proposed the transfer of certain texts of the Radio Regulations to other documents, especially to ITU-R Recommendations, using the incorporation by reference procedure;
- b) that, in some cases, the provisions of the Radio Regulations imply an obligation on Member States to conform to the criteria or specifications incorporated by reference;
- c) that references to incorporated texts shall be explicit and shall refer to a precisely identified provision;
- d) that, taking into account the rapid evolution of technology, ITU-R may revise the Recommendations incorporated by reference at short intervals;
- e) that revised and approved Recommendations will not have the same legal force as the initial Recommendations incorporated by reference until a competent world radiocommunication conference has so decided;
- f) that it would be desirable to ensure, in the cases provided for in the Radio Regulations, that the provisions reflect the most recent technical developments,

noting

that Member States would benefit greatly from being advised, as early as possible, of which Recommendations have been revised and approved during the study period.

resolves

- 1 that each Radiocommunication Assembly shall communicate to the following world radiocommunication conference a list of the ITU-R Recommendations incorporated by reference in the Radio Regulations which have been revised and approved during the elapsed study period;

2 that, on this basis, the WRC shall examine those revised Recommendations, and decide whether or not to update the corresponding references in the Radio Regulations;

3 that, if the WRC decides not to update the corresponding references, ITU-R shall continue publishing the ITU-R Recommendations currently referenced in the Radio Regulations;

4 that WRCs shall place the examination of Recommendations in conformity with *resolves* 1 and *resolves* 2 of this Resolution on the agenda of future WRCs,

further resolves

1 to instruct the Director of the Radiocommunication Bureau to report to the CPM immediately preceding the WRC those ITU-R Recommendations already incorporated by reference in the Radio Regulations which have been revised and approved since the previous WRC, or which may be revised in time for the Radiocommunication Assembly;

2 that, in the case of ITU-R Recommendations which are not currently referenced in the Radio Regulations, only those Recommendations which are in response to a WRC agenda item can be considered for incorporation by reference,

urges administrations

to participate actively in the work of the Radiocommunication Study Groups and the Radiocommunication Assembly in the revision of those Recommendations to which mandatory references are made in the Radio Regulations.

Reason: To establish a procedure to advise Administrations, well in advance of a WRC, of those ITU-R Recommendations already incorporated by reference in the Radio Regulations which have been revised and approved since the previous WRC, or which may be revised in time for the Radiocommunication Assembly. Also to clarify that, in the case of ITU-R Recommendations which are not currently referenced in the Radio Regulations, only those Recommendations which are in response to a WRC agenda item can be considered for incorporation by reference. Minor consequential editorial changes have also been identified.